PMM

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

OCTOBER
1955

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INVESTMENT CASTINGS

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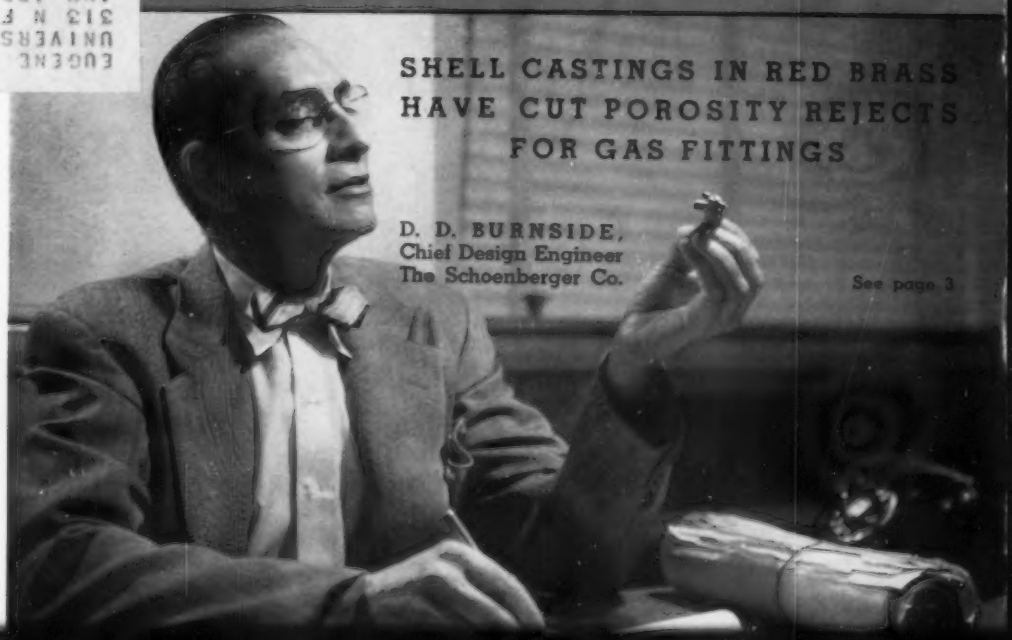
POWDER METALLURGY

SHELL MOLD CASTINGS



SHELL CASTINGS IN RED BRASS HAVE CUT POROSITY REJECTS FOR GAS FITTINGS

D. D. BURNSIDE,
Chief Design Engineer
The Schoenberger Co.

See page 3

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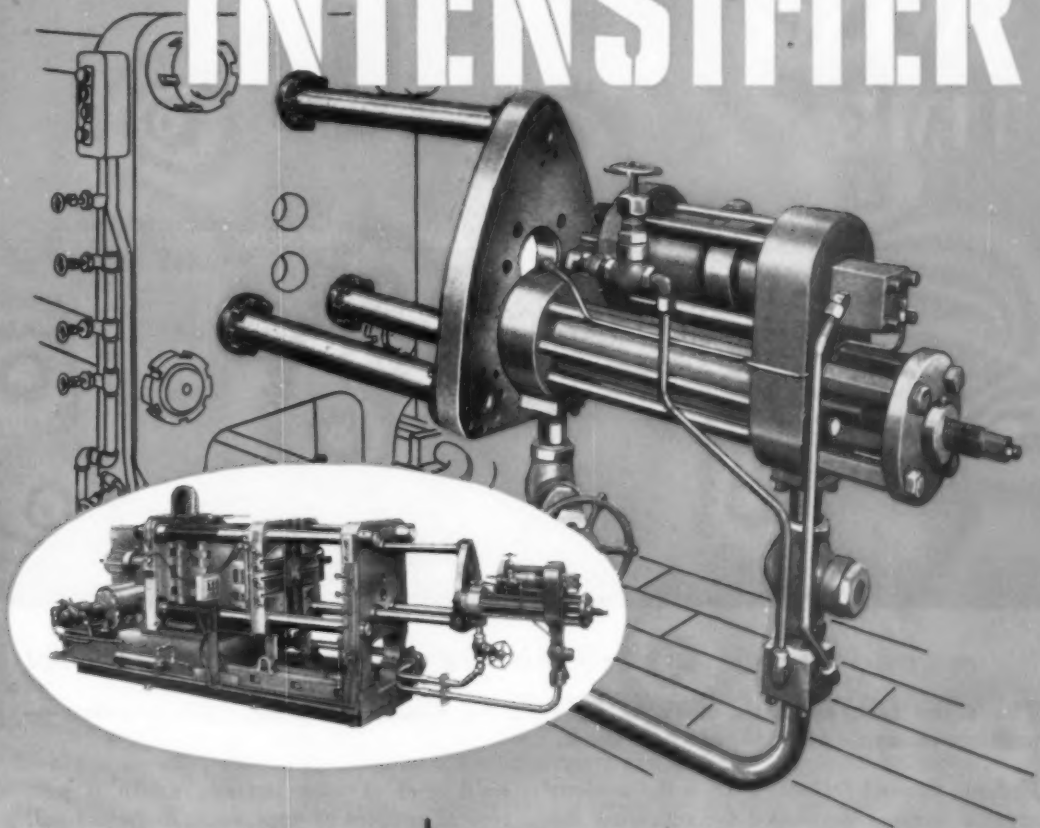

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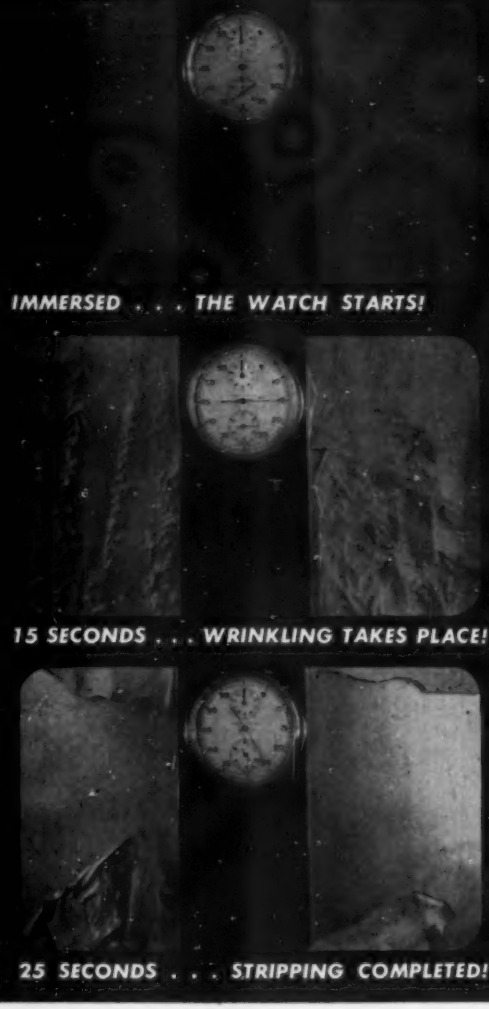

25 seconds from immersion to completed stripping!

That's the fast, dramatic story of ENTHONE Enamel Stripper S-18 in action — another example of *Enthonics at work.**

Enthone Enamel Stripper S-18 is the modern organic stripper developed for removing the newest organic finishes such as Epon or Epoxy coatings and many synthetic enamels from copper, copper alloys, steel and aluminum.

For the right strippers to solve your organic stripping problems fill out a questionnaire we'll send at your request; return it with typical samples of your work. Enthonics will find the answer . . . without obligation!

And ask for your copy of the "Enthone Check List" of literature covering more than 60 products and processes developed for modern electroplating and metal finishing.

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PMM

Oct. 1955

Volume 13 Number 10

Precision Metal Molding

DIE CASTINGS
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PLASTER MOLD CASTINGS
PERMANENT MOLD CASTINGS
POWDER METALLURGY
SHELL MOLD CASTINGS

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Published monthly. Accepted as a controlled circulation publication at St. Joseph, Michigan.

DIE CASTING REPORT

Uniformity - - Less Machining - - - Corrosion Resistance - - Close Tolerances - - are a Few Reasons Why

This wringer-type Maytag washer has 24 die-cast parts.

Wringer parts include: gear case, cap and clutch pulley.

Maytag uses 15 to 20 million die cast parts per year!

Having produced over 9 million washing machines, no one knows better than Maytag Co. the importance of maintaining quality while meeting high production schedules. Die castings have helped solve the problem – at economical unit costs – by providing unlimited qualities of identical component parts. At the same time, aluminum and zinc die-castings have met the critical demands of functional applications. Examples of Maytag requirements. die castings must be (1) oil and water tight for gear cases and housings (2) true to dimension for line assembly with mating parts and (3) free and clear of external surface flaws.

While Maytag is a large user, those with lower requirements may enjoy similar economies and advantages. Let our creative design engineers look at your functional or decorative part needs, at no obligation of course.

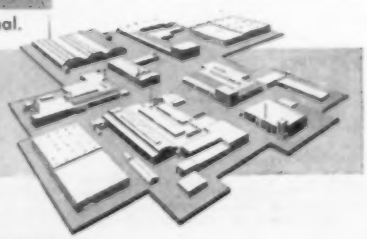
For a copy of: "Die-Castings Unlimited." Address: Precision Castings Company, Inc., 199 Walnut Street, Fayetteville, N. Y.

Formerly sandcast, this washer cover is now an aluminum die-casting.

Small zinc die-cast components, mostly functional.

Switched to die castings from sand castings

Many of the die-cast parts in the Maytag automatic and wringer-type washer were formerly sandcast. Less machining, better surface quality, reduced finishing time are reasons for the changeover. Precision is one of the major die-casting suppliers to Maytag...and has been since 1938.



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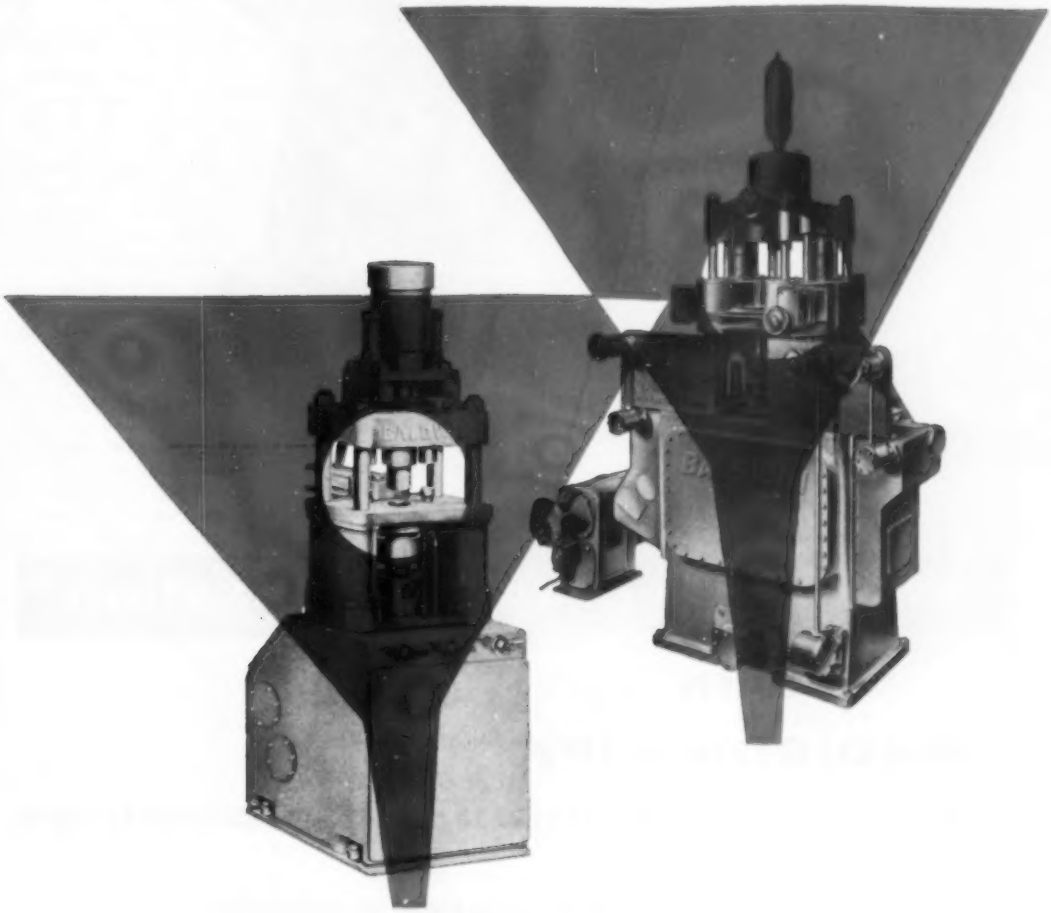
PRECISE FILLING OF DIES *by new Baldwin powdered metal presses makes compacts more uniform . . .*



THEIR highly efficient shuttle type feeders enable Baldwin's new Model "L" and Model "C" powdered metal presses to compact parts much more uniformly. Air operated and cam controlled, this unique feeder moves from under a stationary hopper to a position over the die. It carries the same volume of material over the die cavity each time with a very smooth motion.

This shuttle is supported on guide rods with a spring loaded cutoff ring which prevents loss of material. Cleanline design of the feeder eliminates those recesses or projections that might keep the powder from filling the die cavity completely.

This is just one of the ways you'll benefit by specifying Baldwin Model "L" (50-ton) or Model "C" (100-ton) presses to meet the growing demand for powdered metal parts. These new presses are the very first designed specifically for use in compacting metal powders. Both feature sealed mechanisms, hydraulic heads, special fill adjustments, automatic lubrication and variable cycling.

For our new bulletins on "L" and "C" please write promptly to our Dept. 4756, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

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maximum process utilization

with

MADISON-KIPP

zinc and aluminum die castings

Die casting as a process has marked advantages in providing lightness, strength and stability in parts that can be cast to dimensions requiring a minimum of machining.

Seasoned skill, however, is involved in getting maximum process utilization as in the Madison-Kipp casting here illustrated, developed with the close cooperation of the user and the die designer.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

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• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

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LETTERS TO THE EDITOR

POLAROGRAPHIC ANALYSIS OF ZINC

On page 32 of your Issue No. 1, Volume 6, January 1948, is an article by Milton Sherman on Polarographic Analysis of Zinc Diecasting Alloys. This article is only a general outline of the principles of polarographic procedure, but states... "In articles to follow, manipulative details will be given for the complete analysis of zinc base alloy diecastings."

We wonder whether these articles were published subsequently in your journals or elsewhere, and should be very much obliged if we could obtain from you the references. If this is not possible, could you perhaps be so kind to pass our letter on either to Mr. Milton Sherman or to the firm which he represented at the time ... If the articles have not appeared in print, perhaps Messrs. Silverstein & Pinsof would be kind enough to give us an outline of their procedure in writing. We should be pleased to reciprocate by giving them details of our own polarographic procedure for aluminum alloys ... The field of zinc base alloys is not familiar to us, and we should therefore very much appreciate the technique of a fiem obviously very experienced in this field... Dr. W. S. (Chief Chemist).

The detailed articles, unfortunately, did not appear in print, but the inquiry has been forwarded to Sipi Metals (formerly Silverstein & Pinsof) whose procedures were described in the article.—Ed.

SOURCES

I have been trying to locate some manufacturers of permanent mold machines for casting of aluminum and iron. Could you send me a list of the companies that make this equipment. — R.A.R. (Project Engineer)

I would appreciate it very much if you could provide the name of the company that has developed the "Selinizing" process as mentioned in your September issue of PRECISION METAL MOLDING. — R. H. (Chief, Standards Group).

Information has been sent.—Ed.

The hob (1) a replica in hard tool steel of the finished piece, is pressed into steel blanks to produce hobbed cavities (2) which are then machined (3) for insertion into a die shoe or mold frame.

CUT TOOL COSTS WITH NEWARK DIE HOBBED CAVITIES

Die hobbing is often the key to lower tool costs. This process produces steel cavities with a minimum of machining, filing and polishing operations ... and adds the insurance of maximum uniformity in multiple cavity molds or dies.

What's more, as the steel alternately flows and condenses under the hobbing pressure, the mold takes a closer surface grain structure that more faithfully reproduces detail in the finished product.

NEW!

Write for your free copy of "How and When to Hob." Or let us discuss directly how Newark's complete die hobbing facilities and experience with all sizes and types of cavities may benefit you. No obligation, of course.

NEWARK DIE HOBBING AND CASTING CO.

20 SCOTT STREET, NEWARK 2, N. J. PHONE MArket 2-3305

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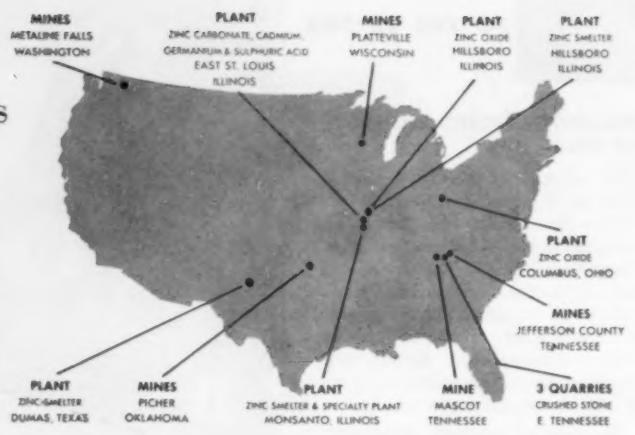
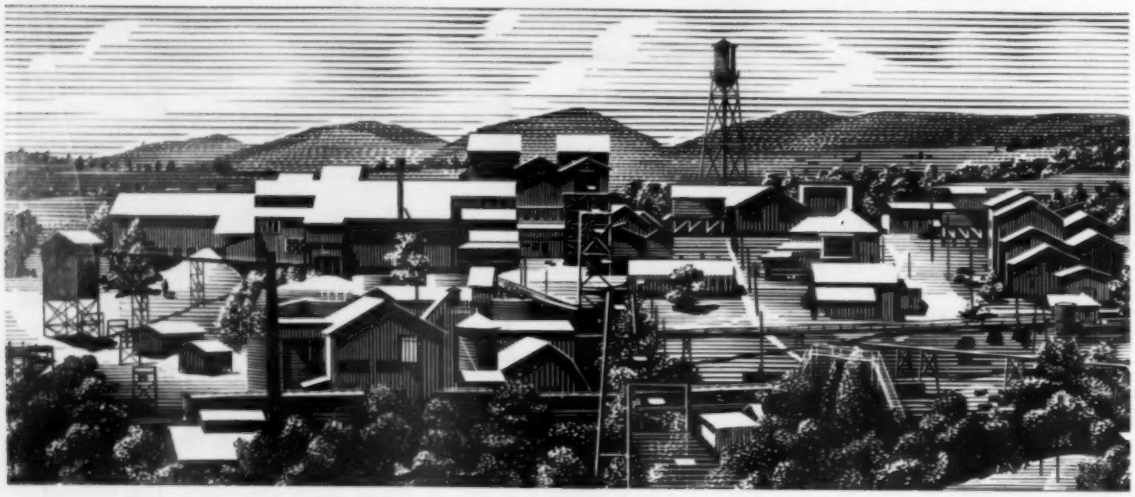
American Zinc and its products *from* A *to* Z





CONCENTRATING MILL,
MASCOT, TENNESSEE

One of the key factors in American Zinc's widespread mining and milling operations. In Tennessee, American Zinc also owns and operates mines in Jefferson County. It is here that one of the largest known reserves of zinc in the United States is found (in excess of 1,250,000 tons of recoverable zinc, proven, with additional large reserves indicated). Other company-owned and operated mining properties are located at Platteville District, Southern Wisconsin; Metaline Falls District, Eastern Washington; and Picher field of the Tri-State Area (Missouri-Kansas-Oklahoma). For the complete picture, see map above.

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A review of recent U.S. PATENTS

ANODIZING ALUMINUM SURFACES. A process for the formation of a clear non-iridescent protective oxide coating on aluminum and aluminum base alloys comprising anodically coating the metal surface in an electrolyte consisting essentially of from about 15 to 40 percent by weight of phosphoric acid and from about 2 to 10 percent by weight sulfuric acid, the balance substantially water.

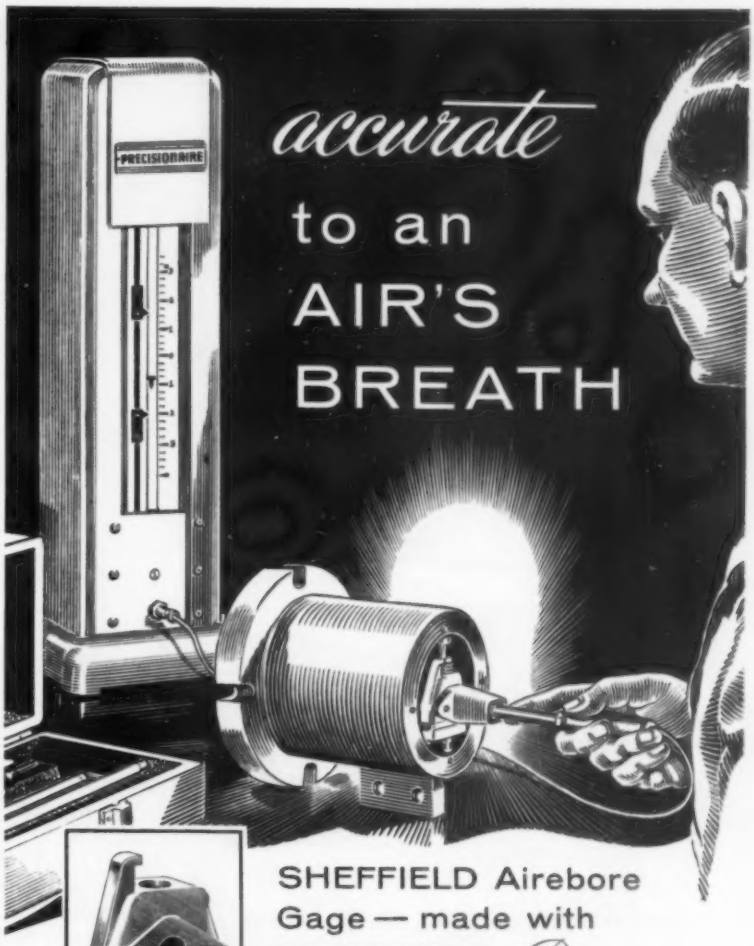
(Patent No. 2,703,781—Frederick H. Hesch — assigned to Kaiser Aluminum & Chemical Corp.—March 8, 1955).

A VACUUM MELTING AND CASTING apparatus in which the melting crucible is positioned below a movable, compartmentalized container to hold melting stock and alloying materials. As the material container is moved, the individual compartments index over an aperture in the base plate of the charge holding device so that material is successively deposited in the crucible. The crucible is mounted on trunions so that the completed melt can be poured into molds. All three major operating units are enclosed within a container fitted with a means of evacuation of the air or gases. All moving parts are equipped with a method of actuating them from outside without breaking the vacuum.

(Patent No. 2,713,183—Device for Melting and Casting Under Air Exclusion—Otto Christion Winkler, assigned to Alois Vogt, Vaduz, Liechtenstein — issued July 19, 1955).

A CEMENTED TITANIUM CARBIDE TURBINE BLADE in which the basic blade is composed of titanium carbide, pressed and sintered so as to have from 30 to 50 percent porosity by volume. The shaped blade is then infiltrated with a high temperature alloy that may be either cobalt, nickel, or iron base. A feature of the blade thus made is that the

Continued on page 38



SHEFFIELD Airebore Gage — made with

HITCHINER *Precision* INVESTMENT CASTINGS

The extreme accuracy of the Sheffield Adjustable Airebore Gage requires highest quality in its parts or components. Yet, they have to be produced in volume lots at low cost. Hitchiner Precision Investment Castings meet these requirements.

Whenever the need for design and production economies in the manufacture of *your* precision metal components arises, you too can turn with confidence to Hitchiner.

Write today for the valuable free booklet containing design and production data on Hitchiner Precision Investment Castings — or write for the name of the nearest Hitchiner representative who can give you full details.

HITCHINER Manufacturing Company, Inc.

Precision Investment Castings

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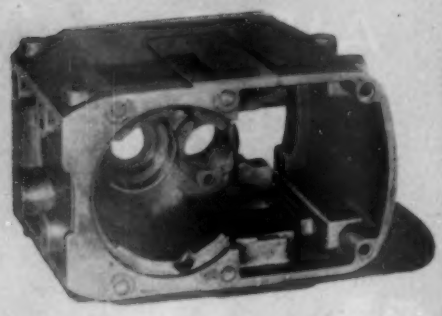
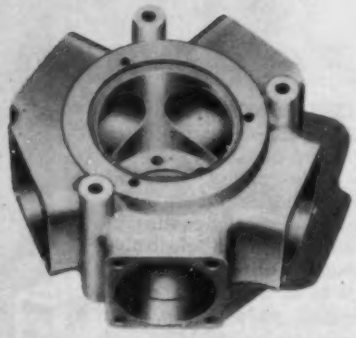
ZINC DIE CASTINGS

complete—in one casting operation



ALUMINUM DIE CASTINGS

complete—in one casting operation



MODERN METHODS to cut component parts costs by PARKER

POWDERED METAL PARTS

complete—in one pressing operation

A sure way to cut your component parts costs is to eliminate production operations. Parker die castings and powdered metal parts save money by reducing—in many cases eliminating—costly machining operations and scrap loss. The parts shown here are typical examples of Parker's skill in these modern production methods. You'll find it worthwhile to check on the cost and design advantages of Parker die castings and powdered metal parts. Just call the nearest Parker Sales Engineer listed here or write the factory direct.

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PARKER WHITE METAL CO., ERIE, PA.

PARKER

ALUMINUM and ZINC DIE CASTINGS
POWDERED METAL PARTS

For more information circle No. 59 on the Reader Service Card

USCO Z-3
USCO Z-5

USCO Z-3 is an aluminum-magnesium hardener for the production of Zamac 3 alloy, and USCO Z-5 is an aluminum-magnesium-copper hardener for the production of Zamac 5 alloy.

USCO Z-3 is used in the ratio of 1 part to 22 parts of 99.99% plus slab zinc to produce Zamac 3 alloy. USCO Z-5 should be mixed 1 part to 19 parts of zinc to make Zamac 5. Both Z-3 and Z-5 can be furnished in the form of shot or 2 pound 6 notch bar.

With either hardener you need make only one addition—saving you the time, trouble and costly facilities necessary for producing your own hardeners. Most Zamac today is produced by adding hardeners such as USCO Z-3 and USCO Z-5. If you have never used USCO Z-3 or USCO Z-5 or alloyed your own Zamac, we ask you to investigate the possibilities with us.

Our metallurgical engineers, who have a practical working knowledge of your problems, are at your service always.

Free...*send for our detailed pamphlet "USCO Z-3 and USCO Z-5 Hardeners."*

USCO

U. S. REDUCTION CO.
East Chicago, Indiana

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SEE

THESE NEW REED-PRENTICE FEATURES AT THE METAL SHOW

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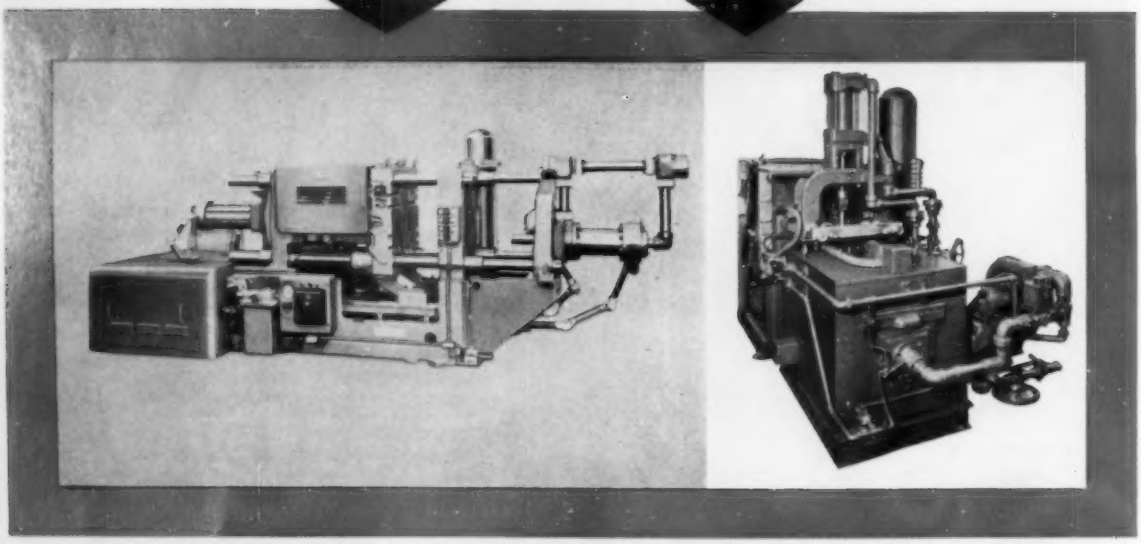

"Hi-Speed, Hi-Pressure" Unit Gives 10,000 in./min. Plunger Speed

Here's the answer to your quality control problems. The new "Hi-Speed, Hi-Pressure" Plunger unit gives you extra-dense, porosity-free castings every time. It increases plunger speed to 10,000 inches per minute, then adds a final high-pressure squeeze to assure uniform quality.

This new unit will be displayed at the Show. It is available on both 1½G and 2G cold chamber die casting machines for use with aluminum and magnesium.

These exclusive Reed-Prentice features have been designed to assure you steady, profitable die casting. Engineers will be at the Reed-Prentice booth to show you the machines on display and consult with you on your problems.

Increased Melting Pot Capacity

See this new Gooseneck and Furnace arrangement that provides 675 lbs. of usable zinc above the liner port. You get more efficient production because:

1. Elimination of stress points increases pot life;
2. You operate longer without refill;
3. Less operator's time and attention is needed.

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BETWEEN THE LINES

PUT THE "SPECIFIC" IN YOUR SPECIFICATIONS when you submit prints for quotations from a jobbing die caster. The more exact are your descriptions of the quality and condition of casting you need, the better are your chances for getting it. Also, you can feel confident that all vendors are quoting on the same work. This is true also of other types of precision metal moldings. To illustrate, PMM has an article this month showing how Stewart-Warner Corp. (who also have a large contract die casting shop of their own) have set up a standard specification system for the many die castings they buy. It begins on page 58.

VACUUM METALLURGY TALK is heard at every technical and trade meeting nowadays. Recently, PMM editors have sat in on both formal and informal talks about vacuum processing of metals. Despite differences of opinion, there is little doubt that this trend toward precision melting, casting, impregnating and finishing under vacuum conditions is growing rapidly. On page 45 of this issue is a three-part discussion of vacuum melting, especially as pertains to investment casting.

HOW TO DRILL AND TAP die castings more economically is the subject of a seven-page report beginning on page 72. Economy starts with the decision concerning which holes to drill and which to core. Many types of setups, machine tools, accessories and control units are available to pick from, but you should have some idea beforehand what to expect when you are planning a drilling and tapping operation. Some of the ideas in this special PMM report may help save you money.

WHAT COPPER DOES when added to an iron powder part is widely known in a general way, but the exact performance and some of the reasons behind it have not been generally recognized. For this reason, the editors of PMM present an article in two parts, beginning on page 55 of this issue, describing research work on the effect of copper powder additions on iron powder compacts.

FLUXING THE MELT requires knowledge and experience. A veteran in the field reports in the November issue of PMM on methods and materials used in fluxing non-ferrous melts.

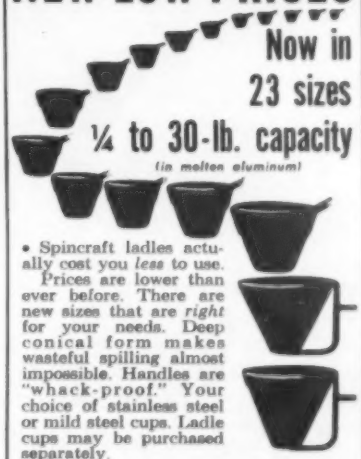
NEW PROCESS AND NEW MATERIAL are reported in two articles in this issue. One is the Ceramicast process, based on the British Shaw process, recently introduced into this country. Description and illustrations appear on page 100. A new material of interest to precision foundrymen is a super-refractory, used for molds, thermocouple tubes and other applications where it must resist erosion from molten aluminum.

NEW LADLES
for non-ferrous metal pouring

• New Spincraft ladle design offers you reinforced cup bottoms and pouring edges of heavier gauge with the weight-saving side walls.

You get improved heat transfer . . . new lighter weight and better balance for "swinging" faster, safer and easier between crucible and mold or machine.

NEW LOW PRICES
Now in 23 sizes
¼ to 30-lb. capacity
(in molten aluminum)



• Spincraft ladles actually cost you *less* to use. Prices are lower than ever before. There are new sizes that are *right* for your needs. Deep conical form makes wasteful spilling almost impossible. Handles are "whack-proof." Your choice of stainless steel or mild steel cups. Ladle cups may be purchased separately.

TRY SPINCRAFT LADLES IN YOUR OPERATION

• You'll never know how good Spincraft ladles really are unless you try 'em in your plant, under your conditions. We're sure they'll *exceed* your expectations in reduced operator fatigue — in much longer ladle life. Write for prices. Complete data on non-standard sizes, gauges, materials quoted on request.

Spincraft
SPELL WILL DO IT
INCORPORATED

4131 West State St., Milwaukee 8, Wis.

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Let **DOLLIN** Engineers

Get the most out of your Die-Casting Designs

—at the lowest possible cost!

LARGE CASTINGS

Aluminum castings made on large cold chamber type high-pressure machines. Large zinc castings made on large plunger type machines.

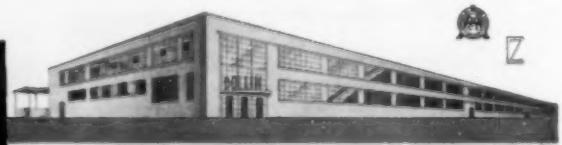
SMALL ZINC CASTINGS

1000 per lb. to 3 per lb., made on fully-automatic machines. More design latitude than other high-speed methods—attractive tool costs and piece prices.

Send blueprints, specs or samples of your parts to Dollin for study and quotation, without obligation.

Based on more than 25 years' experience with thousands of die-cast parts and problems, most likely suggestions can be made that will cut piece costs—include fastening elements—reduce machining and assembly operations—increase strength—or improve appearance.

DOLLIN Zinc and Aluminum **DIE-CASTINGS**



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The 6 grades of Die Slick

Here is brief information on the six different grades of Die Slick—more detailed information will be sent on request.

No. 3—Aids parting and ejection on difficult ALUMINUM and MAGNESIUM castings. Non-staining. Enables better metal flow and fill-out of castings.

No. 4—Expressly for BRASS castings —sometimes used on aluminum and magnesium. Extra heavy-duty compound with lubricating graphite. Retains lubricity under high heat.

No. 9—For clean "hardware" finish ZINC castings, where finest plating results are required. Assures maintenance of clean cavities, cores, ejector pins, and guide pins.

No. 11—General purpose compound for ZINC castings. Generally stain-free unless applied too heavily. Prevents sticking and scoring.

SG—Standard grade compound for general use on ALL alloys except brass. A high viscosity amber fluid that is not readily burned off by the heat of the dies.

PS—Plunger-Slick is an adherent viscous compound that will not melt under highest casting temperatures. Expressly for cold chamber machines, it prevents scoring, sticking, or wear on plunger parts. No. 21—(silver) for average use on all alloys. No. 34—(black) has added micronized graphite for extra high lubricity.

Don't shoot, Davy...try Die Slick!

Ole' Davy can shoot the spots out of the nine of diamonds at 30 paces, but this casting has him stuck. His podner with the Die Slick knows the motto: "Be sure you're right, then go ahead." Next time Davy will be sure . . . Die Slick *prevents* sticking, scoring, and soldering. It will not stain castings, so most cleaning problems end right there.

Unlike b'ar grease or pot-luck lubricants, each of the six grades of Die Slick is uniform from batch to batch, and each yields consistently excellent results. It doesn't cost much, especially when stacked up against the cost of needless rejects and damaged dies. Four out of five die casters use Die Slick regularly. Try a week's supply. Simply specify quantity and the type of alloy on which you will use it. If you're not satisfied, return the invoice unpaid.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

DIE SLICK

used by die casters everywhere

G. W. SMITH & SONS, INC., 5400 KEMP ROAD, DAYTON 3, OHIO

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DATA OFFERED IN THIS MONTH'S ADS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

1. HIGH SPEED DIE CASTING of small parts, up to 1½ lbs. of zinc, can be done on the ABC Machine. Engineering data and prices are given in bulletin A-10.

3. DRY FILM LUBRICATION with colloidal graphite will materially increase die casting production. Acheson Colloids Co. has reprint DC and bulletin 425-Q10 available that describe this material.

6. BRONZE PERMANENT MOLD castings that offer outstanding advantages to the designer are fully discussed and all pertinent data given in the new catalog from Alcaloy, Inc.

12. POWDERED METAL PRESSES that are said to incorporate a number of entirely new features and principles are described in bulletins L and C from Baldwin-Lima-Hamilton Corp.

14. STANDARD AND SPECIAL ALLOYS in all castable metals are listed and fully described in the MasterMet bulletin of technical data from Cannon-Muskegon Corp.

15. FIRE-RESISTANT HYDRAULIC FLUIDS for the promotion of safety and better working conditions are discussed and all of the necessary engineering and technical data given in a booklet, form 7380, from Carbide & Carbon Chemicals Co.

18. PERMANENT MOLD CASTINGS in aluminum, from 2 oz. to 65 lbs., are described in an illustrated brochure from Centr-O-Cast and Engineering Co.

19. AUTOMATIC WAX INJECTION machines that materially speed the production of wax patterns for investment casting are fully covered in bulletin 1202 from Centrifugal Casting Supply Co.

21. EJECTOR PINS AND OTHER mold and die components can be purchased ready to use. The cost saving advantages of these components is covered and the full line of parts available listed in the new Detroit Mold Engineering catalog.

24. IRON POWDERS FOR ANY USE can be supplied by Easton Metal Powder Co., Inc. as reported in technical bulletins available on the different grades of powder being made.

26. HIGH STABILITY METAL POWDERS that meet every requirement for uniformity, purity, consistency, strength and low oxide content fully discussed in technical data available from The Glidden Co.

29. DESIGN AND PRODUCTION data on investment castings is contained in an informative booklet from the Hitchiner Mfg. Co., Inc.

30. SCIENCE OF POWDER METALLURGY, particularly concerning iron powder is the subject of highly informative and technical data that is available from Hoeganaes Sponge Iron Corp.

31. COST REDUCTIONS through the use of die castings by the Hoover Co. are explored in a booklet "Die Castings."

32. HOW TO REDUCE CASTING COSTS in the die casting shop is fully discussed in bulletin 5400 from The Hydraulic Press Mfg. Co.

33. ENGINEERING DATA AND SPECS on presses for forming metal powder compacts are available from Haller, Inc.

38. DIE CASTING MACHINES in all capacities and for all castable metals are completely described in the new Kux Machine Co. illustrated catalog.

41. IMPROVED CASTINGS require precise control of all melting variables. The new Lindberg Engineering Co. induction furnaces which hold these variables to a minimum are described in bulletin 560.

42. DESIGN DATA for the engineer who uses or contemplates using die castings are available from Litemetal Dicast, Inc.

45. STANDARD AND CUSTOM conveyors for handling all types of materials and products at elevated as well as room temperatures are discussed in a catalog from May-Fran Engineering, Inc.

46. SOUND, DENSE die castings are standard production on Midwest-Foster die casting machines. A detailed bulletin from Midwest Machine Co., Inc. describes them.

53. A DESIGN HANDBOOK for the user and prospective user of investment castings has been prepared by the Midwest Precision Casting Co.

57. ADVANTAGES OF ZINC die castings are fully covered in a new brochure published by The New Jersey Zinc Co.

60. SPECIAL WAXES for investment casting are described in technical data available from the Petrolite Corp. Samples are available.

63. DIE CASTING MACHINES which incorporate many new advances such as central hydraulic ejector to allow increased casting size are described and illustrated in literature from Peco Machinery Sales, Ltd.

64. TECHNICAL DATA on metal powders and metal powder products are given in engineering and laboratory reports that are available from the Pyron Corp.

69. PRESSES FOR FORMING METAL powders that embody many new, cost reducing features are described in bulletin 670 from the F. J. Stokes Machine Co.

72. AMORPHOUS TYPE SILICA in micron sizes for the investment casting industry is described and the chemistry and physical properties given in data sheets from Tamms Industries. Samples are available.

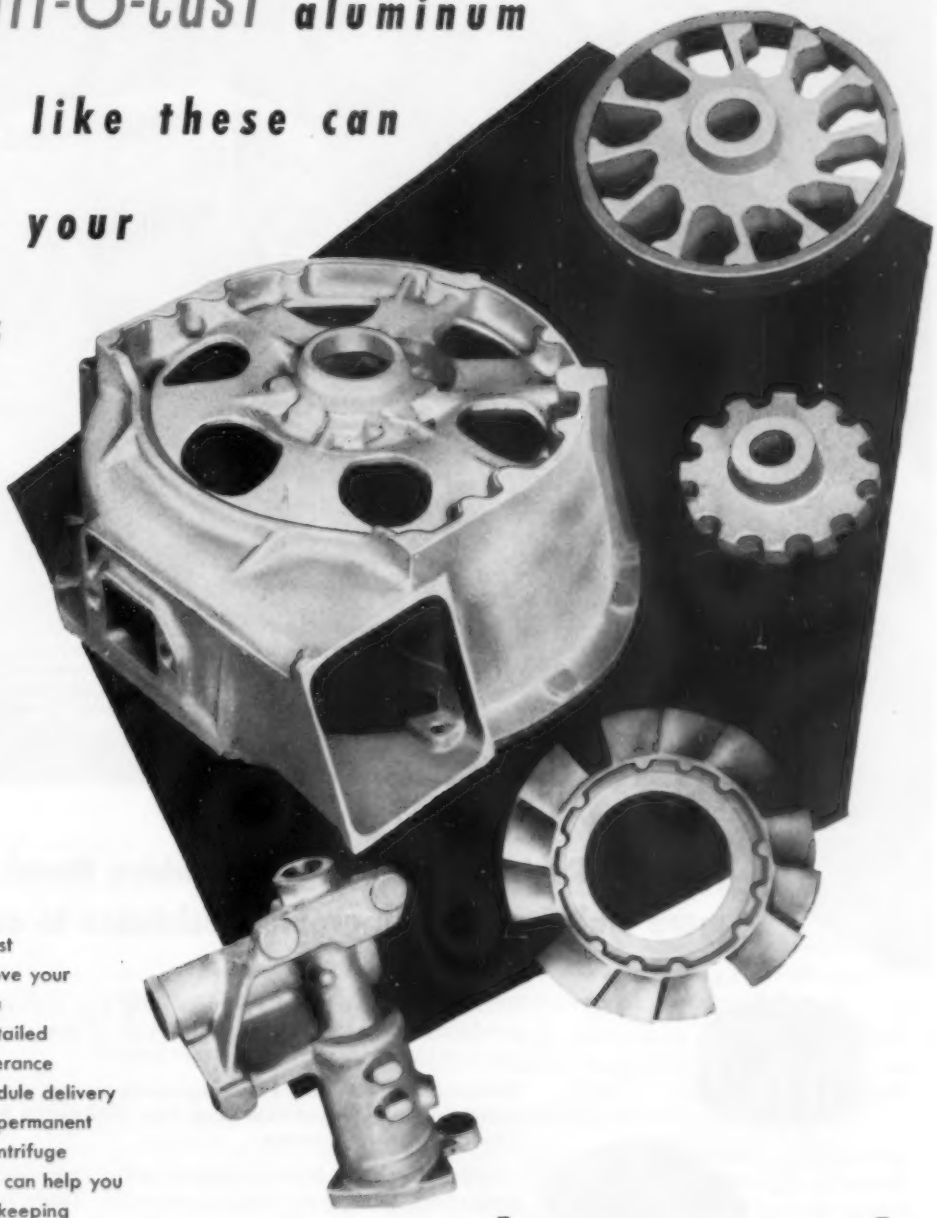
73. MASTER ALLOYS for the production of zinc base die casting alloys are listed together with their chemistry in a detailed pamphlet from U. S. Reduction Co.

76. COST CUTTING through the use of powdered metal parts is the subject of a booklet that has been published by Yale & Towne Mfg. Co., Powdered Metal Products Div.

77. CHEMICAL POLISHING and protective coating of zinc base die castings can be done in one step with the new Iridite. Detailed technical information is available from Allied Research Products, Inc.

Continued on page 19

let us show you how centr-O-cast aluminum castings like these can improve your products



● Here at Centr-O-Cast we can help you improve your products by giving you careful attention to detailed requirements, close-tolerance uniformity and on-schedule delivery on permanent or semi-permanent mold, centrifugal or centrifuge aluminum castings. We can help you quality-wise while still keeping unit costs in line.

Working in all the aluminum alloys, either regular or heat-treated, we are equipped to produce for you castings ranging from 2 ounces to 65 pounds.

Write and tell us your casting problem. A card will bring an illustrated brochure, or, if you prefer, a personal call by our casting consultant.

centr-O-cast

CENTR-O-CAST AND ENGINEERING COMPANY

45 St. Jean Avenue, Detroit, Michigan

51

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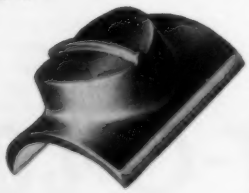
The striking difference in color shows comparative resistance to oxidation, proves superiority of RESISTOX Metal Powder (left) when exposed same length of time as ordinary powder.

Resistox Process gives Glidden Metal Powders more stability through greater resistance to oxidation!



Glidden Resistox Metal Powders offer you distinct storage and production advantages over ordinary metal powders because they resist oxidation from 5 to 10 times longer!

This exclusive Resistox Process permits storage over long periods of time without fear of oxidation, thus eliminating production and product-quality problems.

Glidden Resistox Metal Powders meet every requirement for uniformity, purity, consistency, strength. There is less material waste and die wear. They permit faster production of precision parts with greatly improved finish, appearance and performance characteristics.

Let us supply you with more complete information on these Glidden products: Resistox Copper and Lead Powders, Cuprous Oxide, Cupric Oxide and Cubond (Copper Brazing Paste). There's no obligation.

THE GLIDDEN COMPANY

CHEMICALS • PIGMENTS • METALS DIVISION

Baltimore, Md. • Collinsville, Ill.
Hammond, Ind. • Scranton, Pa.

QUALITY Glidden PRODUCTS

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DATA IN ADS
continued from page 16

79. BRIGHT DIP for zinc base die castings to improve the appearance and give corrosion resistance is discussed in literature on Lustre-on from The Chemical Corp.

80. SPRAY MASKS, MASK WASHERS and machines for automatically spray painting with masks are all described in literature from the Conforming Matrix Corp.

82. LIQUID BUFFING COMPOUND to give better finishes at lower costs is described and many examples of its use given in a folder from Hanson-Van Winkle-Munning Co.

83. DESIGNING WITH THREADED INSERTS is discussed in literature that has been prepared by Heli-Coil.

84. FACTS & FIGURES REPORT on barrel finishing is the new booklet that has been prepared by the Minnesota Mining & Mfg. Co.

88. METAL CLEANING and metal cleaning compounds are thoroughly discussed in the booklet "Some good things to know about Metal Cleaning." Copies are available from Oakite Products, Inc.

90. EXACT TOLERANCES and improved surface finish through the use of the Roto-Finish process is the subject of technical data and reprints available from the Roto-Finish Co.

91. BARREL FINISHING equipment with many new features that contribute to safety and lower costs are described in the catalog from Speed-D-Burr Corp.

92. AUTOMATIC PLATING EQUIPMENT, specifically designed for minimum space requirements and maximum production is described in a folder from Frederic B. Stevens.

95. SMALL PARTS DIE CASTING machines that are said to be the lowest cost, safest machines available are described in a 24-page booklet, "Die Casting Small Parts." Copies are available from DCMT Die Casting Machines Div., British Industries Corp.

96. AUTOMATIC SHELL MOLD making machines that can produce completely cured shells at the rate of 50 or more per hour are described and illustrated in a brochure from Shell-O-Matic, Inc.

"Sorry to interrupt—but the boys are having trouble with the aluminum melt again"

Yes, aluminum can get "balky". Especially when melting conditions are conducive to absorption of Hydrogen. Also good gating and risering is vital to reducing other porosity, such as trapped air and internal shrinkage.

You'll find the answer to such common problems as de-gassing, gating and risering, etc., in a new booklet especially prepared by our Metallurgical Department. It's yours for the asking . . . just write to this department for your copy of "How to Melt and Cast Aluminum Alloys".

This is one of the research and service facilities offered to industry by the Geo. Sall Metals Co. Our Metallurgical staff is always at your service and will be glad to consult with you (in person or by telephone) on any matter related to non-ferrous metals. We will also create and produce special alloys to meet any special requirements you may desire.

See us at Booth 1062 at the National Metal Exposition in Philadelphia, Oct. 17-21, 1955.

For superior service on non-ferrous metals, call . . .

"Better Alloys for Better Castings Through Creative Metallurgy"

The George Sall Metals Co., Inc.

2304 EAST BUTLER STREET — PHILADELPHIA 37, PA.

PRODUCERS OF: Aluminum, Brass and Bronze and Zinc Alloy Ingot; Hardeners, Z-shot and bar for Zamak production; Salloy; Special Alloys

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RIFLE MAKER'S TARGET: LOWER PART COSTS; GRC ONE-PIECE DIE CASTING SAVES 86%!

Automatic safety catch shown at left, die cast by GRC in one piece, replaces safety catch formerly assembled from 3 separate parts. Saving 12c per unit!

GRC die casts automatic safety catch for Crosman Arms Co. for less than 2c each—formerly 14c each. 1/7th of former costs!

The three-piece assembly of an automatic safety catch for the famous Crosman gas-powered rifle cost over 14c apiece. GRC's unique one-piece die casting techniques produce a functionally identical catch at a cost of considerably less than 2c apiece. **A saving of about 86%!**

These Cost Sheet facts tell their own story:

Parts A, B & C plus assembly	**.....$143.00 per thousand**
GRC 1-piece integral die casting	**....$ 16.50 per thousand**
Saving	**$126.50 per thousand**

This is just one example of the way Gries helps industry cut costs. By precision die casting of zinc alloy tiny parts in one piece — and in one automatic operation — substantial savings in time and money are realized. Designs can be simplified, reducing or completely eliminating machining and assembly operation. The die cast Crosman catch is not only lower in cost, but is actually a superior part: one-piece casting eliminates possible loosening of assembled parts and provides greater precision. Better appearance, too, resulted from GRC's die casting design flexibility.

Gries' techniques can make parts to the most precise specifications and mass-produce them in quantities of 100,000 to many millions. Smallness is unlimited (maximum weight ½ ounce, maximum length 1 ¾ in.) Widest scope of design is available.

An informative Die Castings Bulletin is available. Send for your copy.

Gries Makes Extensive Line of Die Cast Zinc Alloy Threaded Fasteners

Gries produces by their exclusive die casting technique a line of high quality, low cost threaded fasteners, including wing nuts, cap nuts, wing screws, round-head thumb nuts, round-head thumb screws, rivets, which are available in a wide range of sizes. Quick delivery from stock. Special to order. All are non-ferrous, rustproof, with clean threads and bright finish. GRC mass production techniques provide lower costs. A new bulletin is now available. Write for your copy of Gries Industrial Fasteners Bulletin.

GRC "Intercast" Die Casting Offers Multiple-Parts Units with Movable Parts

In one automatic operation, Gries can "intercast" die cast tiny parts with movable elements, completely assembled, trimmed and ready to use. Elements fit precisely, yet move freely. Production of individual multiple-unit products or continuous "intercast" units is fast, economical and unique.

The "sister-hook", picture frame swivel rings, scissors, loose-leaf binder rings are 2-element movable "intercast" parts, whereas the chain shown in the photo is an example of continuous "intercasting". Send for samples and full information.

Gries Booth at Metal Show will Have Many Demonstrations of Unique Die Cast Part Applications

When you visit the National Metal Exposition in Philadelphia, Oct. 17 thru 21, be sure to visit Gries' Booth. Gries' exhibit will feature small zinc alloy and tiny molded parts, showing, by use of end products, stripped down assemblies, and individual part illustrations, some of the many advantageous applications for small parts in the electrical, surgical, personal product, electronic, heavy hardware, toy, etc. fields. Also an interesting display of many hundreds of small parts that are in daily use in a great cross section of American industry will be shown. You're cordially invited to visit us — don't forget Gries' Booth — 240.

WORLD'S FOREMOST PRODUCER OF SMALL DIE CASTINGS

GRIES

GRIES REPRODUCER CORP.

157 Beechwood Ave., New Rochelle, N. Y. NEw Rochelle 3-8600

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DOES YOUR COMPONENT PART REQUIRE:	
1. COST REDUCTION	
2. HI-STRENGTH	
3. CORROSION RESISTANCE	
4. MANY MACHINING OPERATIONS	
5. THAT IT BE MADE FROM BRASS, BRONZE, OR ALUMINUM	
6. IMPROVED APPEARANCE FOR SALES APPEAL	
7. INTERLOCKING PARTS	
8. HIGH-STRENGTH BEARING QUALITIES	

If you can check one item on this list, send us your blueprints for estimating . . .

We'll prove to you

ALCALOY

can save you money on

COMPONENT PARTS

We have a new permanent mold casting process and an exclusive bronze alloy that team up to give you a big cost reduction advantage in your products. Keep these facts in mind when you're designing and planning production.

Alcaloy castings are uniformly close-grained, clean, sound and free from cavities and surface flaws. All dimensional tolerances are held within specifications. This means low machining costs, less scrap, less shop equipment. First costs of castings often are lower than other types.

Our special bronze alloy is non-sparking, non-magnetic, corrosion-resistant and light gold bronze in color. It remains free from tarnish and pitting. Some grades have the strength of steel and hardness of C 35-40. This alloy is valuable in safety tools, machine parts, chains, fittings, utensils and many other products.

We are increasing our facilities to insure prompt delivery on component parts. Send us blueprints or return the coupon below for the complete, money-saving Alcaloy story.

ALCALOY, INC.
P. O. BOX 503 TRENTON, NEW JERSEY
ASSOCIATED WITH DICKEY INDUSTRIES

*** ACCURATE INSPECTION INSURES UNIFORM QUALITY**

Every phase of Alcaloy production is supervised by experienced metallurgists. We are licensed by U. S. Atomic Energy Commission to use Cobalt 60 in testing castings for internal flaws. You can depend on Alcaloy quality.

Send information on Alcaloy Casting Process ☐
Send new Alcaloy catalog ☐

Name _____ Title _____
Firm _____
Address _____
City _____ Zone ____ State _____

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NOW... fire-resistant hydraulic fluids at the viscosities you need—

Celanese*

CELLULUBE*

SAYBOLT SECONDS @ 100° F.

90 150 220

The new Cellulube series of fire-resistant hydraulic fluids — in 3 viscosity ranges — clears the way for many new applications.

In addition to fire resistance and excellent lubricity, Cellulube hydraulic fluids have the following advantages:

non-corrosive	low volatility
controlled viscosity	thermal stability
non-foaming	high boiling point

In the die-casting field, Cellulube 150 and 220 are already standard hydraulic fluids. Now Cellulubes find applications in...

furnace combustion controls in steel mills and oil refineries... coke ovens, furnace tilters, loaders and ingot carriers... electrical welders, extrusion presses, forging and multiple action presses.

Your Celanese representative will be glad to give you full details. Or write for samples and technical data to:
Celanese Corporation of America,
Chemical Division, Dept. 589-J
180 Madison Avenue, New York 16.

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HYDRAULIC FLUIDS SPECIALLY ENGINEERED FOR SPECIFIC APPLICATIONS

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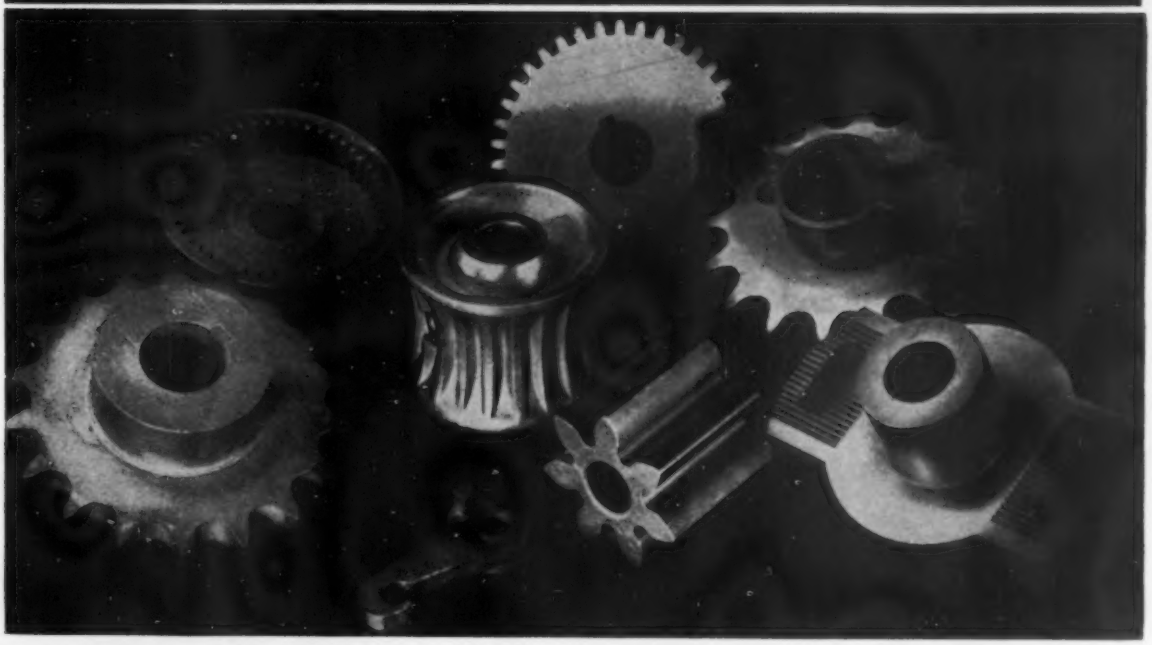
POWDER METALLURGY NEWS

An informative service by HOEGANAES SPONGE IRON CORPORATION, manufacturer of *HOEGANAES SPONGE IRON POWDERS*



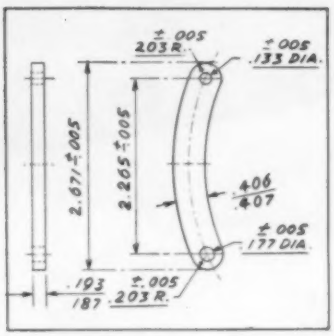
IRON PARTS MECHANICAL PROPERTIES INCREASED BY ADDITIVE COPPER

Limited amounts of copper powder added to iron powder is one popular way to increase the mechanical properties of iron parts.

Recently, Hoeganaes completed some practical tests which show the influence of various factors on the properties of iron-copper parts. The factors involved were sintered density, sintering time, sintering temperature, heating rate, and other additives.

These test results became an important section in the Hoeganaes Data Book, a technical reference manual available to production men in powder metallurgy. *Copies of this section* are available on request—on your company letterhead, please.

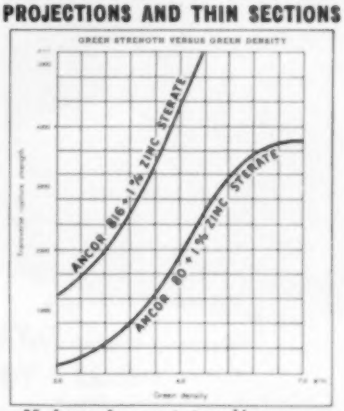
FARM MACHINE MANUFACTURER BENEFITS BY CLOSE FIT UNITS



A famous farm machinery manufacturer found that cost savings were not the only advantage of producing metal parts by powder metallurgy.

Other tangible achievements included *closer fitting mating units. Reduced noise* in operation was another advantage and resulted in smoother, more quiet operation. This finished machine part is enduringly anti-corrosive and *self-lubricating* for a long life.

HIGH GREEN STRENGTH AIDS PROJECTIONS AND THIN SECTIONS



Values for *outstanding* green strength of Hoeganaes Ancor 80 and Ancor 816 are determined by this test.

The powder, mixed with 1% zinc sterate, is briquetted into test bars. The bars are broken in a fixture according to M.P.A. standard No. 13-51T for determination of transverse modulus of rupture.

New, Free Informative Literature

Describes basic advantages and production short-cuts by powder metallurgy. This literature is in addition to above offer.

Hoeganaes Sponge Iron Corporation,
Riverton, New Jersey
Please send me your free literature on Powder Metallurgy.

Name .....
Company .....
City ..... Zone ... State .....

HOEGANAES
SPONGE IRON POWDERS

Superior grade metal parts from superior grade iron powder.

HOEGANAES SPONGE IRON CORP.
545 Fifth Avenue, New York 17, N. Y.
Plant: Riverton, New Jersey

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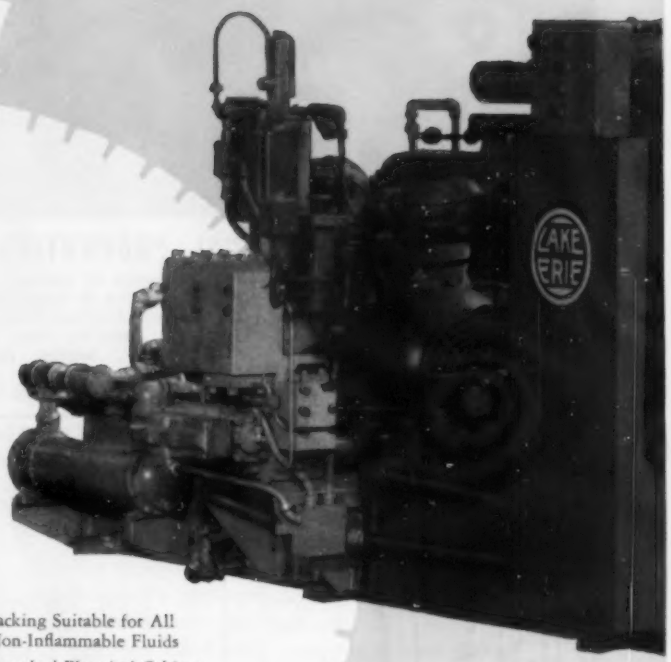
NOW... *A Die Casting Machine that*

EXPANDS WITH YOUR NEEDS

- Available in capacities of 250, 450, 650 and 850 tons.
- Hot chamber or cold chamber models as desired.
- All models are equipped with an improved version of the highly successful Wedge Cam Toggle. The incorporation of knuckled joints eliminates the use of pressure pins when under locking pressure.

by **LAKE ERIE**
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.
LAKE ERIE®



TODAY...

- Buy the unique Lake Erie Series D "expandable" Die Casting Machine as a basic tool with only the essentials required for your present production. This saves money . . . yet gives you rugged characteristics and top quality never before obtainable in a simplified machine. Incorporated in all models of the new Series D are:

- Larger Die Area
- Low-Stressed Tie Bars
- Faster, Smoother, Die Closing
- Lower Frame — Engineered Working Height
- Manifold Valving
- New Knuckled, Wedge Cam Toggle
- Simplified Electrical & Hydraulic Systems
- Easier Conversion from Aluminum to Zinc
- Packing Suitable for All Non-Inflammable Fluids
- Detached Electrical Cabinet
- Reserve Pumping Capacity
- Mechanical Ejection
- Automatic Lubrication

OPTIONAL EQUIPMENT

- Safety Hook
- Screw for Die Height Adjustment

TOMORROW...

As you get into different types of production, you add any of the following features you need. They can be installed fast, at low cost, right in your plant.

- Multiple Corepull Valving
- Patented "Pressure-Pac" Injection System for Aluminum
- Hydraulic Ejector
- Safety Shield
- Die Cooling System
- Thermostatic Control of Water
- Power Unit Covers
- Positive Adjustable Cylinder Stops
- Vacuum Die Evacuation System
- Cold Chamber Plunger Assembly
- Hot Chamber Furnace Controls

WRITE FOR DETAILS

Send today for Circular 255 describing this new and unusual "expandable" Die Casting Machine.

LAKE ERIE ENGINEERING CORPORATION

520 Woodward Avenue, Buffalo 17, N. Y.

For more information circle No. 39 on the Reader Service Card

if it's DUCTILITY you're after...

... in your iron powder parts, check this torsion test. It shows what can be done with parts made from HVA electrolytic iron powder.

actual, full-size photographs

LARGE PART... or SMALL ONE

A FULL 360° COLD TWIST applied to typical parts, demonstrates an important fact to designers and buyers. It shows that these high density parts, made from HVA electrolytic iron powder, can equal — or even exceed — the properties of wrought materials of the same composition. And it means that a whole new range of parts, once obtainable only by costly machining of wrought stock, can be made economically from iron powder.

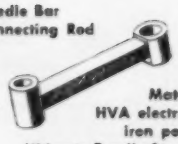
High density and high ductility are only two of the many advantages designers can expect from parts made of HVA electrolytic iron powder. It will pay you to investigate all the ways it can improve your present products, inspire future ones.

MECHANICAL PROPERTIES of the torsion-tested sewing-machine parts

Feed Connecting Fork

Material: HVA electrolytic iron powder ($3.4\ g/cm^3$) + 2% copper
Ultimate Tensile Strength: 57,000 psi
Yield Strength: 46,000 psi
Elongation: 15%

Needle Bar Connecting Rod



Material: HVA electrolytic iron powder
Ultimate Tensile Strength: 40,000 psi
Yield Strength: 29,000 psi
Elongation: 32%

For facts on how HVA electrolytic iron powder can improve your product, write to:

A. JOHNSON & COMPANY, INC.

21 WEST STREET • NEW YORK CITY 6, NEW YORK

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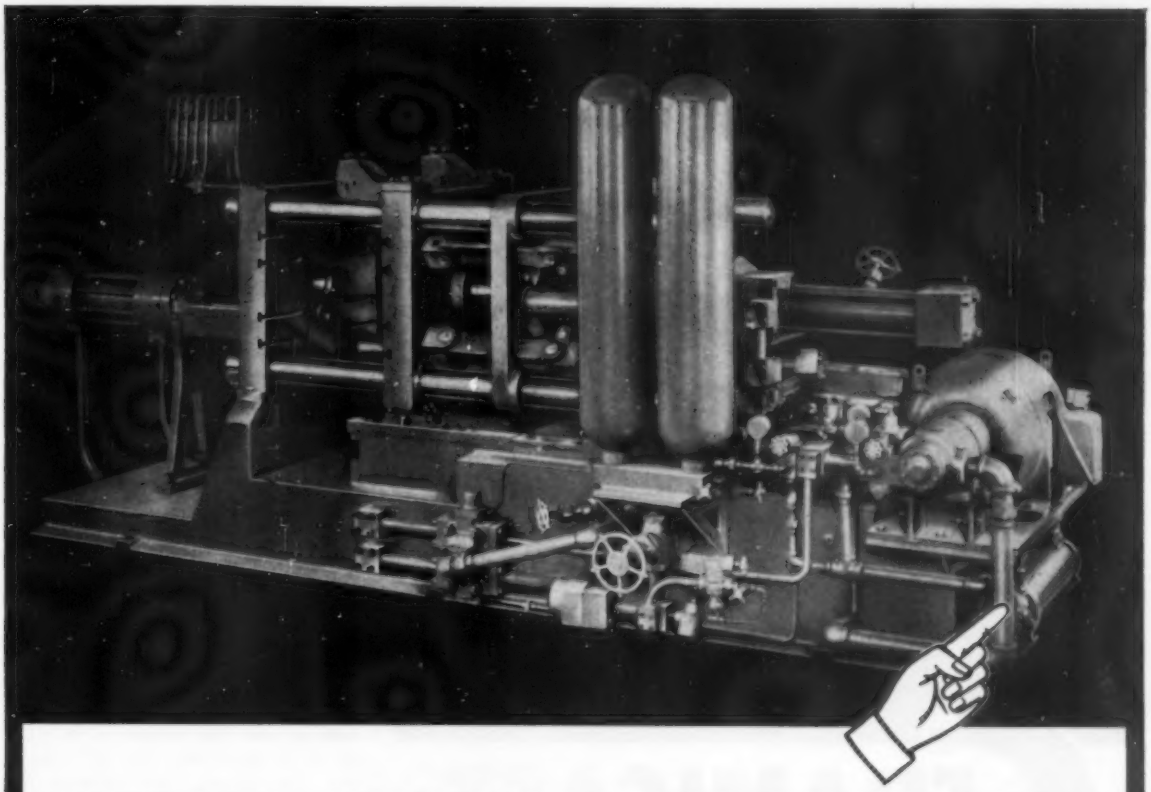

RUGGED, COMPACT ROSS EXCHANGER
insures rated power of this B-T die casting machine

There'll be no overheated, thinned oil to cause pump slippage here.

Neatly installed next to the hydraulic pumps of this B-T Cold Chamber Die Casting Machine is a compact Ross Type BCF Exchanger. It provides safe, dependable oil cooling at all times. *Rated hydraulic power is thus insured!*

Says B & T Engineering & Sales Co., "We have used Ross Exchangers for many years and they have proven themselves reliable."

Using past experience as a basis for selection, numerous manufacturers of hydraulic equipment install Ross Exchangers with impressive regularity. Not only are these compact, copper-alloy units top rated for thermal efficiency, but they're ruggedly built to withstand punishing hydraulic shock. Pre-engineered and fully standardized, they're promptly available in a wide range of sizes to answer most needs.

For detailed information, request Bulletin 1.1K5.

ROSS EXCHANGERS

KEWANEE-ROSS CORPORATION

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

1446 WEST AVENUE • BUFFALO 13, N. Y.

In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

Serving home and industry: AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS & WALL TILE • DETROIT CONTROLS • KEWANEE BOILERS • ROSS EXCHANGERS • SUNBEAM AIR CONDITIONERS

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NOW! LOW COST CLOSE TOLERANCE CASTINGS

CERAMICAST*

...Lebanon's new steel casting process offers purchasing agents and design engineers these quality and price advantages:

FOR QUALITY

- **CLOSE TOLERANCES.** As close as + or — .003" to .005" per inch.
- **INTRICATE SHAPES.** Ideally suited for producing castings of complex design and detail.
- **THIN SECTIONS.** Metal sections as thin as 1/32 of an inch. Knife-like edges down to .030" or less.
- **SMOOTH SURFACES.** Surface variations held to 125 micro-inches or better.

FOR PRICE

- **LOWER PRODUCTION COSTS.** Jobbing wood or metal patterns can be used. Design changes are quick and inexpensive.
- **REDUCED MACHINING COSTS.** Smooth, accurate castings greatly reduce or eliminate machining costs.
- **SHORT LEAD TIME.**

ADAPTABLE TO MANY CASTING SIZES AND ALLOYS—casting weights up to one hundred pounds or more. Carbon steel, conventional low alloys, stainless steels and the superalloys.

SEND US YOUR BLUEPRINTS. Our sales engineering department will show you how the revolutionary Lebanon CERAMICAST Process can be adapted to your project design.

*produced under licensing agreement with Shaw Processes, Ltd., London, England.

CIRCLE L

LEBANON STEEL FOUNDRY

168 LEHMAN STREET LEBANON, PENNSYLVANIA

CARBON, LOW ALLOY AND STAINLESS STEEL CASTINGS

For more information circle No. 40 on the Reader Service Card

NAMES IN THE NEWS

John M. McCarthy has been appointed district sales supervisor of the *Coated Abrasives Division of Armour and Company.*

H. J. Buttner has been appointed manager of engineering for the *Le Roi Division of Westinghouse Air Brake Company.*

Dr. F. P. Bowen, reader in physical chemistry, *University of Cambridge,* England, is to be this year's recipient of The Franklin Institute's Elliott Cresson Medal. The award is to be given Dr. Bowen for "his extensive experimental investigations which combine simplicity and clarity, and for his findings regarding the detailed nature of the processes involved when one metal slides over another."

Vanadium-Alloys Steel Company announced the appointment of **Charles F. Sawyer** as works manager of the Latrobe Mill, replaces **Frank Moberg,** who has retired.

Dr. F. J. Dunkerley, who for five years has served *Rolle Manufacturing Company* as a metallurgical consultant was named assistant general manager.

Oakite Products, Inc. has announced the appointment of **John C. Mullarkey** as its technical service representative in Phoenix, Arizona.

F. Paul Ronca, manager of the *Silicon Carbide Products Engineering Department of the Carborundum Company* was elected chairman of the Technical Committee of the Abrasive Grain Association.

Cecil E. Gordon has been named sales engineer in the southwest territory for the *Engelberg Huller Company, Inc.* Mr. Gordon will make his headquarters at South Marsalis, Dallas, Texas.

A dinner was held recently in New York to honor **Dr. J. E. Stareck** upon his completion of 20 years service with *United Chromium.* Dr. Stareck was presented with a gold watch by **R. O. Loengard,** vice president of *Metal & Thermit Corporation.*

R. D. Jacobs, II, has been appointed sales manager for the *Custom Die Company.*

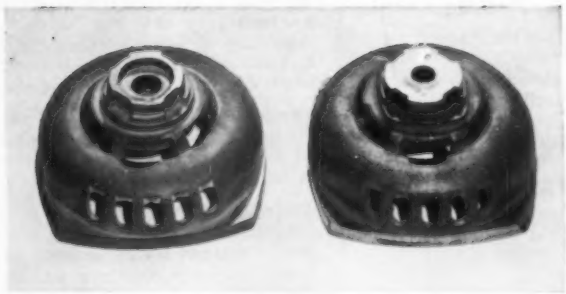
Appointment of **Leon H. Decker** as assistant works manager of the foundries and pattern shops, industries group, was announced by *Allis-Chalmers Manufacturing Company.*

John P. Holmes, vice-president of *Celanese Corporation of America* has been elected to the board of directors.

Continued on page 30

shell molding

cuts machining and polishing —IN HALF!



Identical motor end-frames of gray iron showing advantages of shell molding over green sand casting. Shell molded frame on left needs only finish reaming in center hole and precision boring on large diameter. Rough and semi-finishing operations have been eliminated at both points—all polishing has been eliminated. Resulting in: lower cost per piece, greater production, less rejects.

Many cast parts can be used as they emerge from shakeout; others require only minimum finishing (see photo). They're smoother—free from surface gas holes...they're sounder—have more uniform grain structure. Plenco phenolic shell-molding resins form light dimensionally accurate molds, and are adaptable for most metals, even hard-to-cast metals like ductile iron. Molds made of Plenco resins are extremely durable—they can be stored indefinitely for future use, are easily moved from one location to another. Whatever you are now casting in sand—whether it's brass plumbing fittings or high strength automatic transmission parts—it can be produced faster and at lower cost by shell molding with Plenco phenolic shell-molding resins. For better cast products investigate shell molding with Plenco resins—today!

P

FOR PLENCO PHENOLICS PLASTIC PRODUCTS

PLASTICS ENGINEERING COMPANY
Sheboygan, Wisconsin

Serving the plastics industry in the manufacture of high grade phenolic molding compounds, industrial resins and coating resins.

For more information circle No. 61 on the Reader Service Card

This alloy list keeps getting longer and longer!

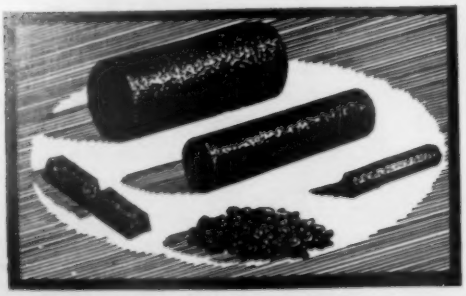
Cannon-Muskegon can supply scores of special and standard alloys for remelt or reprocessing, certified to your exact specifications

*NI RESIST
SAE 1020
SAE 4130
SAE 52100
SAE 6150
SAE 8630
AMS 5382B
AMS 5385B
AMS 5388
PWA 651
ARMCO 17-4-PH
4750
AISI 300 SERIES
AISI 400 SERIES
*MONEL
*INCONEL
ACI-H7
18-4-1
IIB2
IID2
INVAR
CO-CR-W ALLOYS
CU-NI ALLOYS
NI-CR ALLOYS
NI-FE ALLOYS
NI-CR-FE ALLOYS
CR-FE ALLOYS

*International Nickel Co.

A *long* alloy list is an excellent indication of long alloy experience! As source for many of the nation's major investment casting suppliers and others, Cannon-Muskegon furnishes a great variety of alloys for remelt or reprocessing. Alloys include super stainless and tool steels, as well as nickel and cobalt-base alloys. Other alloys are prepared specially for medical, aeronautical, electronic, industrial and experimental uses.

These alloys are in addition to a wide range of carbon and 300 and 400 series stainless steels regularly carried in stock for *immediate* delivery. Remember . . . no matter what type alloy you specify each is backed with a notarized metal analysis insuring *exactly predictable* physical, chemical and electrical properties.



MASTERMET ALLOYS are available in either ingot, shot, hexagon bar, billet or 12"-long, 6" diameter cast round bar form. Alloys are shipped in drums with specifications clearly imprinted for fast selection and storage.

WRITE for your copy of New MasterMet Bulletin and technical data on the complete MasterMet alloy service.

Cannon-Muskegon
CORPORATION
2871 Lincoln Street • Muskegon, Michigan

MASTERMET

METALLURGICAL SPECIALISTS

For more information circle No. 14 on the Reader Service Card

PEOPLE IN THE NEWS — cont.

A. Milne & Company has announced the opening of a new sales office in Madeira Beach, Florida under the direction of **Carl Buehler.**

Maurry R. Petersen has been appointed sales engineer in the Ohio territory for *The George Sall Metals Co., Inc.*

Raymond F. Stevens has joined *Acheson Colloids Company* as research chemist. Mr. Stevens will supervise the expanding basic research program under the direction of **Dr. Harold J. Dawe,** director of research and development.

Dr. David W. Levinson, a specialist in physical metallurgy, has been appointed supervisor of non-ferrous metallurgy research in the metals research department at *Armour Research Foundation of Illinois Institute of Technology.*

J. D. Kraeger has been named sales engineer in the west coast territory for the *Engelberg Huller Company, Inc.* Mr. Kraeger will make his headquarters at Los Angeles, California.

Clinton F. Ivins, Jr., has been appointed assistant manager of electrical sales at *Hanson-Van Winkle-Munning Company.* Mr. Ivins will be particularly concerned with the marketing of low voltage rectifiers and will have general responsibilities in the entire electrical sales program.

Everede Tool Company announced the appointment of **Butler C. Brewen** as its exclusive sales representative in the Detroit area.

Two additions to its sales and service staff have been announced by *E. F. Houghton & Company.* **C. Guy Rivers** has been appointed as technical sales engineer in the Philadelphia area, southern New Jersey and the state of Delaware. **Edward L. Babcock** was named as hydraulic engineer in the Central New England area.

Crucible Steel Company of America has appointed **George F. Groff** to the position of secretary. As secretary, Mr. Groff succeeds **Kurt R. Vogel,** who held the position from 1940 until his death earlier this month.

Oliver A. Gottschalk, formerly assistant to the president of *The Carborundum Company* has been elected treasurer-controller. **George J. Zimmerman,** staff assistant for management controls has been named assistant to the president.

Dr. Hamnett P. Munger, has been appointed chairman of the Chemical and Metallurgical Engineering Department at *Syracuse University.*

John A. Jost has joined *Kewanee-Ross Corporations' Ross Heater Division* as heat exchanger development engineer.

HYDRAULIC DANGER ZONE

Ordinary hydraulic fluid, escaping under pressure, can start a fire 40 ft. or more from a broken line! Is your plant safe? Here's how another firm protects men and machines inside the danger zone...

IT'S 1250° *HOT*... BUT HYDRAULIC LINES ARE SAFE WITH PYDRAUL!

MINNEAPOLIS-HONEYWELL REGULATOR CO.'s safety director reports: "Two weeks after we switched from flammable hydraulic oil to Pydraul F-9 in 7 die-casting machines, a line break sprayed Pydraul—at 1000 psi—into a pot of molten aluminum at 1250°F. With petroleum fluid there might have been a disastrous fire but with Pydraul there was no fire or loss of production time. Employees feel better knowing the fluid in our lines won't spread fire."

BETTER LUBRICANT THAN PETROLEUM OIL

In tests of *both* major lubricant requirements—film strength and resistance to wear—Pydraul outperforms petroleum oil! In Shell 4-Ball test using petroleum oil, scar diameters resulting from 90 lbs. pressure measured 2.71 mm. Using Pydraul, they measured only 1.08 mm.—less than half the wear!

To help *you*—we've put the WHY, WHERE and HOW Pydraul is being used in one complete new booklet. It covers such subjects as packings, paints, change-over, and reclaiming, etc.... for your FREE copy write Organic Chemicals Division, MONSANTO CHEMICAL COMPANY, Box 478-Z-7, St. Louis 1, Mo.

Pydraul: Reg. U. S. Pat. Off.

Serving Industry...

MONSANTO
CHEMICALS – PLASTICS

Which Serves Mankind

For more information circle No. 49 on the Reader Service Card

IT'S A GOOD IDEA TO HAVE A CHECK UP OCCASIONALLY

and if you produce

DIE,

SAND

or **PERMANENT MOLD CASTINGS** **HENNING**

has a prescription for **BETTER RESULTS** at **LOWER COST!**

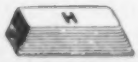
No matter how long you have dealt with your present source, there's nothing to be lost by analyzing the advantages of HENNING as an alloy supplier. For nearly thirty-four years we have furnished the most discriminating buyers in the country with ingot unsurpassed anywhere in the world. This, coupled with Service of the highest order, has won and held customers from coast to coast.

ZINC BASE ALLOYS

Special Hi-Grade Slab Zinc, Waffle Slab Zinc, Zinc Anodes, Zinc Aluminum Alloys. Zamak (Die-Casting) Alloys.

ALUMINUM INGOTS

Secondary Aluminum Ingot (All Grades and Alloys) For Sand, Permanent Mold, and Die Castings All Deoxidizing Grades.



BRASS & BRONZE INGOTS

(Made to Customer's Specifications) Tin Bronzes, Lead Tin Bronzes, High Lead Tin Bronzes, Leaded Red and Semi-Red Brasses, Yellow and Hi-Strength Brasses and all Grades of Nickel-Silver (White Bronze) Ingots.

LEAD AND TIN BASE ALLOYS

Soft Lead, Antimonial Lead Mixtures, Solders and Babbitts All Ingot Produced Under Laboratory Control.

ANODES FOR PLATERS

CADMIUM ANODES (Virgin — Domestic Quality)
ZINC ANODES (Ball and Flat Top)
LEAD ANODES (Both regular and Hi-Speed for Chrome Plating)

HENNING BROS. & SMITH, INC.

91-113 Scott Avenue • Brooklyn 37, N. Y.

DEPENDABLE SERVICE SINCE 1922

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CASTING ABOUT

INVESTMENT CASTING SALES in 1955 will probably top those of last year by 60.7 percent, according to predictions of companies included in a survey just completed by the Investment Casting Institute. Ted Operhall, ICI president, points out that the Institute's Sales and Net Profit Survey shows that average 1954 sales for companies reporting amounted to $957,953.

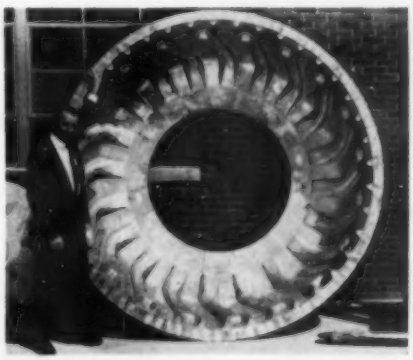
The report, completed by the CPA firm of Seeley and Evans, shows that sales are up, but profit averages are below those of competing industries. Total volume for 1955 is expected to reach $125,000,000.

Operhall explains that the expected rise in sales is the result of the accelerated procurement of jet engine components. The current trend to use investment cast components over those produced by other processes is most significant. Higher operating temperatures require alloys not readily forgeable and the engineers are designing hollow vanes which can only be produced economically by the investment casting process. Other new markets and customers are also being opened up to investment castings because of the tremendous latitude in design available to engineers.

Copies of the completed sales and profit report are available from the Investment Casting Institute, 27 East Monroe Street, Chicago, at a cost of $50.00 per copy.

MAGNESIUM CASTINGS shipments were up 12 percent for the first half of 1955 as compared with the similar period of 1954, and were up five percent in the second quarter over the first quarter of this year. Die castings and permanent mold castings in magnesium were both up, totalling 2985 tons this year against 2259 tones the first half last year. Figures are released by The Magnesium Association, based on data from the Bureau of Census.

WORLD'S LARGEST cast tire mold was recently shipped to Goodyear Tire and Rubber Company from the Yellow Springs, Ohio foundry of Morris Bean and Company. Made of aluminum and weighing 1800 pounds, this cast tread ring is made by the Antioch Process. Two mating mold halves will be used at Goodyear to make tires for road building equipment.



MANGANESE INSTEAD OF NICKEL is being used in new stainless steels being studied by Allegheny Ludlum Steel Corp. This action, prompted by continuing shortages of nickel, may assure ample future supplies of austenitic stainless steels.

Early work done during temporary periods of nickel shortage, has been supplemented with recent development. During the Korean war, the company offered a 15% chromium, 15% manganese, 1% nickel alloy. Now, several others are available or under development. These include a 17-4-6 chromium-nickel-manganese in sheet and strip and 18-5-8 chromium-nickel-manganese. Properties of the 17-4-6 include desirable high strength and corrosion resistance, good formability, easy weldability. The 18-5-8 was developed as an alternate for Type 302, and has properties similar to that material. The chrome-manganese family is not yet complete, company researchers say, and development work is continuing.

Continued on page 35

Important
New Developments
FROM
THE CHEMICAL CORPORATION
Research Laboratory

LUSTER-ON M

A new, quick *one dip* bright-clear treatment for zinc. Used in very dilute 2% solution to give a bright, attractive finish with good corrosion protection.

LUSTER-ON STAIN PREVENTIVE

For the large volume producer of zinc plating. A very economical finish for long shelf life. Suggested uses are on electrical conduits, outlet boxes, plated sheet stock, wire screening.

LUSTER-ON NL-C

A one dip bright conversion coating for cadmium requiring no leaching.

LUSTER-ON NS

The answer to "spotting out" troubles on copper and brass plate, especially under humid conditions. Is suitable for use on thin deposits. Improves clear lacquer adhesion.

LUSTER-ON ALUMINUM SEALER (222-M)

Produces a chromate film on aluminum that provides excellent corrosion protection and can serve as a paint base. Now can be dyed in many attractive pastel colors. Meets Government Spec. MIL-C-5541.

Ask for literature. Send a sample for free laboratory treatment.

You'll also be interested in our Safety Division's line of industrial skin cleaners and protectors . . . protect your workers and your products. Literature available.

L-17

THE *Chemical*
CORPORATION
66 WALTHAM AVENUE, SPRINGFIELD 9, MASS.

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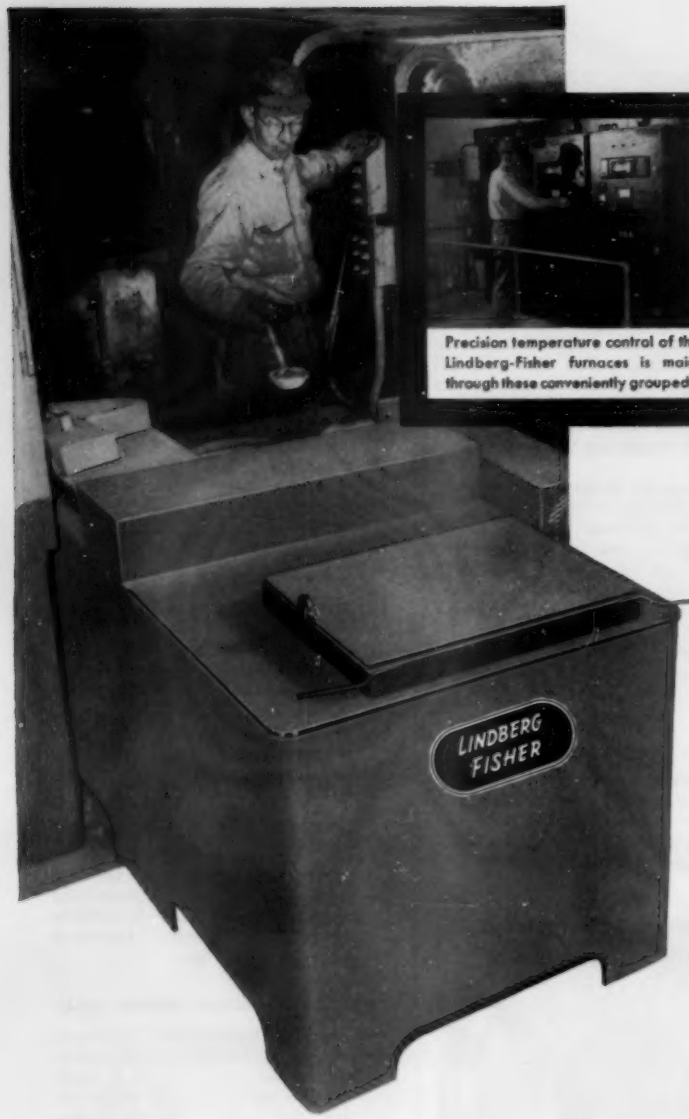

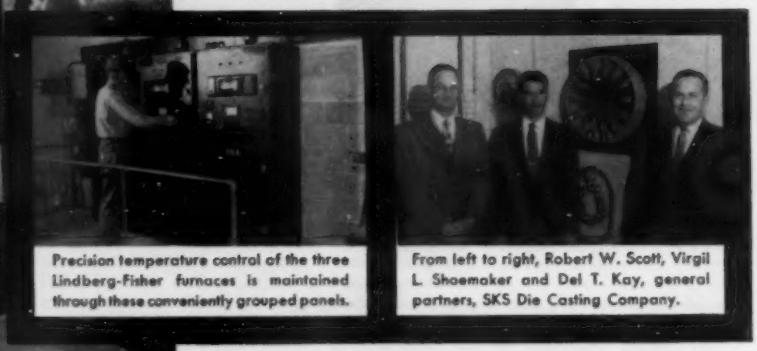

Precision temperature control of the three Lindberg-Fisher furnaces is maintained through these conveniently grouped panels.

From left to right, Robert W. Scott, Virgil L. Shoemaker and Del T. Kay, general partners, SKS Die Casting Company.

"Outstanding Improvement"

IN CASTING METHODS WITH LINDBERG-FISHER INDUCTION FURNACES

● SKS Die Casting Company, Berkeley, California, is engaged in critical close dimensional work in casting fuel cell fittings for aircraft. To achieve consistent results extremely close control of metal temperature is essential.

Mr. Del T. Kay, SKS general partner, says: "We had no previous experience in induction melting and holding and sought the best advice we could find. As a result, we have installed three Lindberg-Fisher two-chamber Induction Melting Furnaces. These fulfilled our requirements completely and represented an *outstanding improvement* over our previous methods."

Like SKS, you will also find that Lindberg-Fisher Induction Melting and Holding Furnaces provide these advantages: cleaner molten metal, continuous production, cooler operation and minimum maintenance. Ask us to recommend the proper type of furnace for your particular needs or write for our Bulletin 560.

LINDBERG-FISHER MELTING FURNACES

LINDBERG ENGINEERING COMPANY, 2463 WEST HUBBARD STREET, CHICAGO 12, ILLINOIS

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CASTING ABOUT
continued from page 33

FAST, RESIN BONDING of Shell mold halves has been achieved through use of this new shell-bonding machine, recently added to G-E Chemical Materials Department's experimental shell-molding laboratory here. Foundry technical service engineer, Jack E. Bolt, is shown placing the hot cope (top half) on the hot drag

(bottom half), before spring pressure is applied by the machine. The new technique eliminates a bottleneck in the process caused by use of mechanical fasteners. Hitherto, production was slowed by lack of an effective method of joining shell halves. In the foreground is a new dimensional-study pattern; halves are lifted from the pattern and placed on the machine for bonding. Believed to be the most complete laboratory of its kind, the G-E foundry permits study of all factors affecting the shell-molding process.

FIBER METALLURGY is a new metal forming technique recently announced by Armour Research Foundation of Illinois Institute of Technology in Chicago. Unique feature is the starting form of the metal . . . short metal fibers. It is possible to produce a wide range of porosities, combined with high strength and toughness, according to Dr. Arthur G. Metcalfe, senior metallurgist at the Foundation. Many operations are said to be similar to those used in powder metallurgy. Similarity of felting process used in paper making is noted.

The process: fibrous material is suspended in liquid which is poured over a filter while applying suction to form a felted layer. After drying, it can be sintered, coined or impregnated. It can be pressed to higher density.

POWDER METALLURGY can duplicate this part for

61% LESS

MACHINED PART — 18¢
POWDERMET* PART — 7¢

Don't cut parts—*Cut Costs!*

—with YALE Powdered Metal Parts

When it comes to keeping production costs down, American industry turns more and more to powder metallurgy. For here are tough, accurate parts completely ready for assembly...that not only do the job more cheaply, but often *better!*

With identical machined parts, most of the cost goes into the expensive machining operation. The price of *one* machined part will buy up to *six* of the same parts in powdered metal!

Close tolerances, excellent wearability, and controlled porosity are established Powdermet* virtues. Special properties—such as self-lubrication, or unusual electrical characteristics—can also be achieved. Alloys are available exceeding the tensile strength of mild steel.

The answer to your production problems may well be Powdermet* parts...and Yale & Towne. For Yale & Towne has the experience and know-how to serve you best in this rapidly-developing new field.

A qualified Yale & Towne engineer is available to discuss the advantages and limitations of powdered metal parts—*right in your own plant!* He will show you how powder metallurgy may cut costs in *your* production operations. There is no obligation for this engineering counsel.

YALE & TOWNE

THE YALE & TOWNE MANUFACTURING CO
Powdered Metal Products Division
9335 BELMONT AVE. • FRANKLIN PARK, ILL.

TYPICAL PM PARTS

Filters	Gears
Bearings	Cams
Switch Parts	Keys
Wheels	Valves
Sprockets	Ratchets
Pawls	*And many more*

Get your copy of this informative new booklet now!

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9335 West Belmont Avenue
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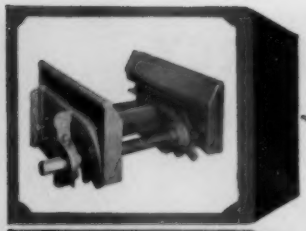
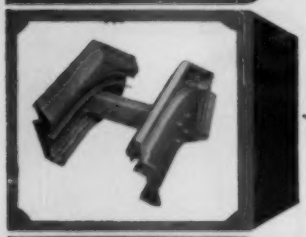
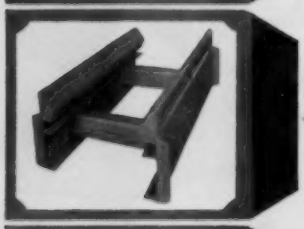
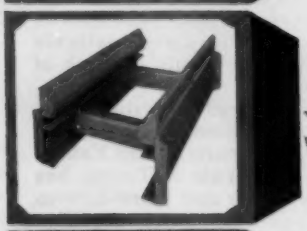
☐ Send Booklet ☐ Send information on PM parts for attached specifications or drawings.
☐ Have a Yale & Towne Powdered Metal engineer call on me.

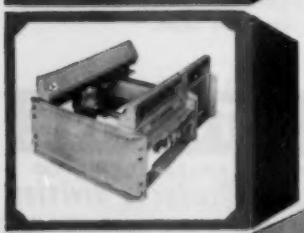
Name..... Title.....
Company.....
Address.....
City..... Zone..... State.....



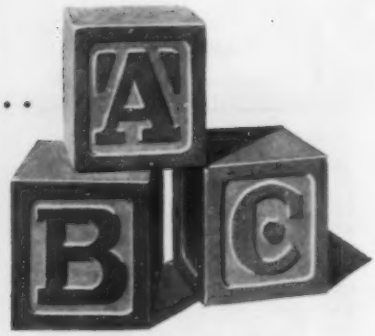








as basic as . . .



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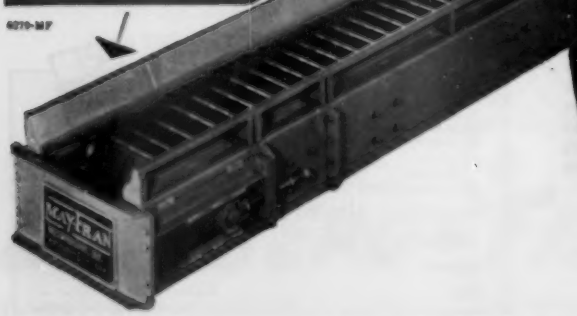

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WHY ZINC RATES FIRST IN DIE CASTING • NUMBER 5 OF A SERIES

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ZINC FOR DIE CASTING ALLOYS

The Research was done, the Alloys were developed, and most Die Castings are based on

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PATENTS
continued from page 9

entire outside surface has a coating of the infiltrant material about 0.0001 thick except where the means of fastening the blade in position is located where the coating is thickened and at the trailing edge where the edge for a distance of about 1/32" is substantially all infiltrant material.

(Patent No. 2,714,245—Sintered Titanium Carbide Alloy Turbine Blade—Claus G. Goetzel—assigned to Sintercast Corp. of America—issued August 2, 1955).

A POWDER METALLURGICAL METHOD for fabricating heat resistant metal parts such as turbine blades, buckets, nozzles, vanes and other gas turbine parts. Powdered metal from the group consisting of tungsten, molybdenum, tantalum, columbium, titanium and zirconium, mixtures of these metals or their carbides are mixed with a skeleton binder metal. The powder is pressed to shape and then sintered to form a strong porous body. The porous body is later infiltrated with a lower melting metal to form a part of full density.

The refractory powder is all 20 microns or smaller particle size and the part before infiltration has a pore volume between 37 and 59 percent by volume. The infiltrant is selected from the group of iron, nickel, cobalt and chromium or mixtures of these metals.

(Patent No. 2,714,556—Powder Metallurgical Method of Shaping Articles From High Melting Metals — Claus G. Goetzel — assigned to Sintercast Corp. of America—issued Aug. 2, 1955).

A METHOD OF RECOVERING TITANIUM in the form of high-purity metallic product from crude tianium bearing material. The titanium bearing material is treated to form titanium carbide. The carbide is then reacted with gaseous iodine to form titanium tetraiodide. The iodide in gaseous form is then brought against a heated surface at a temperature of 1100 to 1700C to effect decomposition of the iodide and deposition of the metallic titanium.

(Patent No. 2,714,564—Production of Metallic Titanium — Alfred C. Loonam—assigned to Chilean Nitrate Sales Corp.—issued Aug. 2, 1955).

PRODUCTION OF METALLIC TITANIUM by electrolysis of an alkali metal fluotitanate in a substantially anhydrous fused salt bath. The bath consists of the alkali metal fluotitanate and at least one halide salt from the alkali metal and alkaline earth group. An improvement consists of incorporating in the bath a halide of an extraneous tetravalent metal of the group consisting of zirconium, hafnium and thorium. The latter halide comprising at least 0.2% by weight of the alkali metal fluotitanate in the bath.

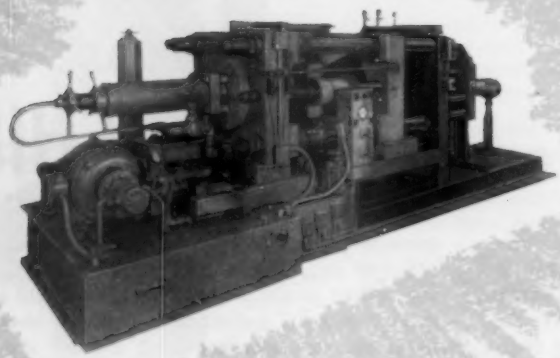
(Patent No. 2,714,575—Production of Metallic Titanium — Eugene Wainer—assigned to Horizons Titanium Corp. — issued Aug. 2, 1955).

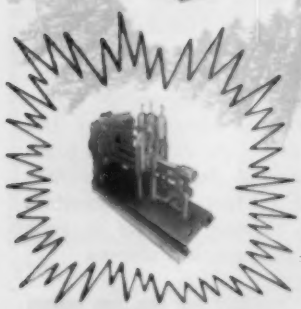
A PROCESS FOR OBTAINING MOLYBDENUM which consists of electrolysis of a bath containing 15 to 40 percent, by weight, of potassium hexachloromolybdate and 85 to 60 percent, by weight, of an alkali halid electrolyte. The electrolysis is carried out in an inert gas atmosphere.

(Patent No. 2,715,093—Electrolytic Production of Molybdenum Powder and Coherent Deposits—Seymour Senderoff and Abner Brenner—assigned to the United States of America—issued Aug. 9, 1955).

Continued on page 111

Midwest-FOSTER
DIE CASTING MACHINES
FOR SOUND PRECISION CASTINGS





A NEW FEATURE! Midwest-Foster — Newly designed JET-SPEED — HI-PRESSURE injection end permits infinite adjustment of shot cylinder — easily and quickly up to 6 inches below center.

Other features include heavy framing and platens, positive clamping action, maximum injection speeds and pressures, hydraulic and electric interlock safety factors, minimum maintenance, all of which guarantee sound precision castings at lowest cost.

Injection assembly permits safe, efficient ladling of metal. Adjustment of jack screw and 2 gland nuts, simplify positioning of shot cylinder. No additional piping or flexible tubing required.

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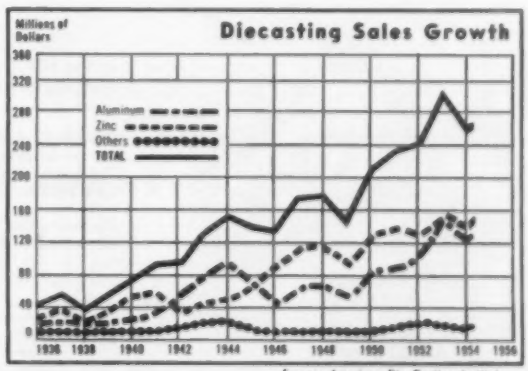
700,000

Zn Die Cast per day...

how else would you make them?

THIS ACCOMPLISHMENT IS TYPICAL of a process that can mass-produce—direct from the raw material—precise, complex-shaped close tolerance units economically. In the fast-moving automotive industry, designing with die castings ensures the high-speed and economical production of many components. This year, for example, the industry needs 76 million door and window handles. These handles are being zinc die cast at the rate of 700,000 per day—how else would you do it?

On the 1955 cars the front end assemblies alone of 16 different models contain from 22 to 40 pounds of zinc die cast parts each. The excellent physical properties of zinc are also increasingly utilized for a great variety of functional automotive parts. Because die casting actually is the "shortest distance between raw material to finished product," it is the outstanding production technique for innumerable components of home appliances, instruments, hand tools, business machines, electrical equipment and many other products basic to the American economy. In fact, the die casting industry consumes over one-third of the total zinc used annually in this country.



Source: American Die Casting Institute.

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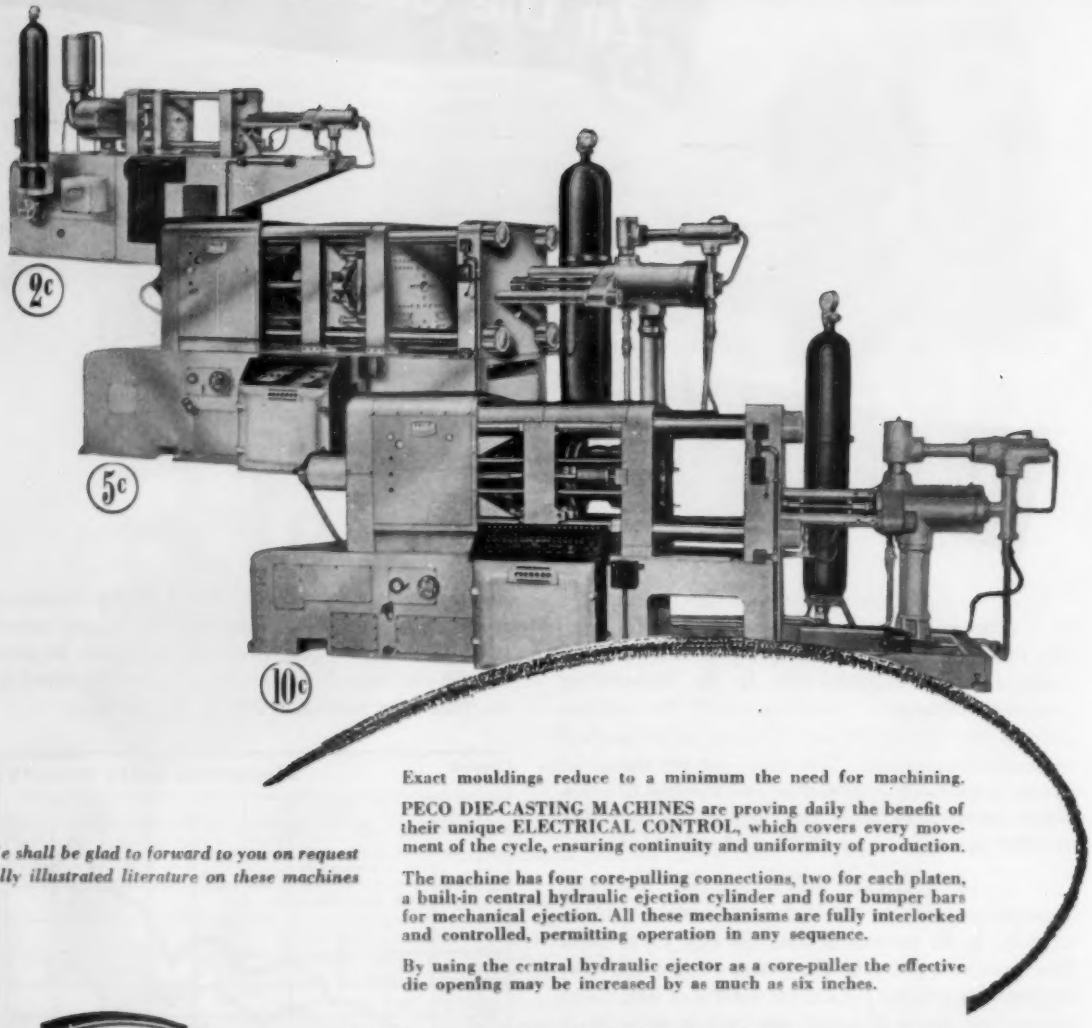

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PECO DIE-CASTING MACHINES are proving daily the benefit of their unique ELECTRICAL CONTROL, which covers every movement of the cycle, ensuring continuity and uniformity of production.

The machine has four core-pulling connections, two for each platen, a built-in central hydraulic ejection cylinder and four bumper bars for mechanical ejection. All these mechanisms are fully interlocked and controlled, permitting operation in any sequence.

By using the central hydraulic ejector as a core-puller the effective die opening may be increased by as much as six inches.

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The company has developed an important new range of HOT CHAMBER die-casting machines, which will be of considerable interest to manufacturers.

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NEW versatile STOKES powder metal press

A new 50-ton multiple-motion press offers increased economy to powder metal molders

Here is a powder metal press so new, so radically different from anything in the field today that it presents entirely new possibilities for efficient industrial compacting. With its simplified tooling and fast operation, the 640 press outdates all other designs; makes possible the application of powder metal to the production of parts for which the process has never before been considered economical.

The Stokes Model 640 is a completely new design, based on an intimate knowledge of the industry's requirements. It represents the latest achievement in Stokes 35-year experience in the design and manufacture of presses specifically for powder metallurgy.

For example, the 640 press is the first to give full, *50-ton simultaneous breakaway* on multiple lower punches, important in successful ejection of complex parts; *centralized controls*, for easy, fast set-up and operation; *independent adjustments* of all press actions while the machine is running; *direct-reading handwheel calibrations*, that eliminate guess-work on settings, permit exact records for each piece produced.

If you are now compacting powdered metals or are investigating how this economical process can be applied to your production, you should know about the many exclusive features of the Stokes Model 640 press. Write for Bulletin 670.

F. J. STOKES MACHINE COMPANY
PHILADELPHIA 20, PA.

The pieces shown are typical of parts for which the Model 640 press is particularly well suited. Difficult parts like these and pieces with double hubs, multiple levels and thin flanges all can now be made economically on the Stokes Model 640 press.

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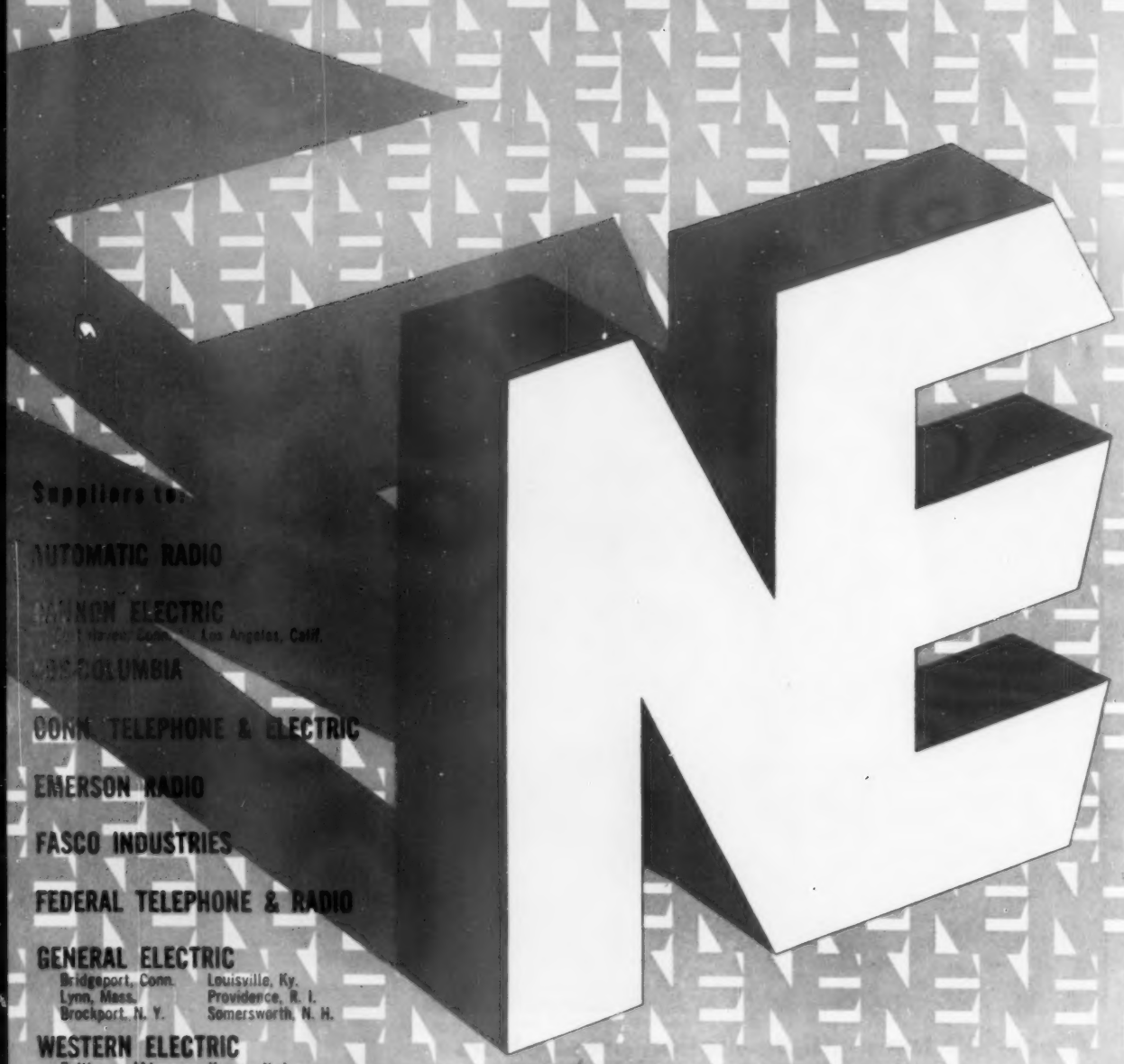

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SPECIAL PMM REPORT

FIVE EXPERTS ON THE METALS SUPPLY SITUATION who addressed the principal session of the American Die Casting Institute September 15 are: l. to r., Robert K. Beck, Howard L. Young, Charles R. Ince, Edward R. Bergman and Don Wilmot. Published here is a summary of their remarks on . . .

The 1956 Metal Supply Picture

ZINC

W. J. During, President, the American Die Casting Institute, led off the discussion of the zinc supply, stating that "the gyrations of the zinc market have vitally affected our business." He noted the short supply situation of 1946-47, the "tariff-squeeze market" of 1952-53, and the "whirling price periods when the quoted price for zinc changed so rapidly that no one could tell either yesterday's or tomorrow's price." Predicting that about 360,000 tons of zinc die castings will have been produced in 1955, he stated that this high volume "has largely been due to the recapture of the automotive market."

Charles R. Ince, Vice President and Sales Manager, St. Joseph Lead Co. commented that, after a six-year period of sharp price fluctuations, "we seem to be entering a period of relative stability and minor price fluctuations. Despite an increase of 1½¢ per pound . . . zinc has advanced only 13% in a year, a fluctuation considerably less than that in most other metals."

Expecting little price change during 1956, he explained, "The recent rise of ½¢ per pound appears to have just about compensated miners and smelters for the higher cost resulting from this year's round of wage increases. Roughly, it takes 100 man-hours to produce a ton of zinc — 60 for mining and milling and 40 for smelting. Wage agreements call for 10¢ an hour increase across-the-board exclusive of fringe benefits, equivalent to $10 per ton of metal — just the amount of the recent increase."

Mr. Ince stressed the increasing relative production of Special High Grade Zinc in comparison with the lower grades. American Zinc Institute figures show, he said, that 40% of current production is now in the 99.99+ metal, compared to 30% a year ago.

New facilities, and converted older facilities for the production of the Special High Grade were pointed out as an indication of the mining industry's attempts to increase the output of this metal used principally for die casting.

Mr. Ince also compared growth in consumption of die cast zinc, rising from less than ½ lb. per capita in 1929, to an average of 5 lbs. during the first six months of 1955, accounting for 38% of total domestic zinc consumption.

Howard L. Young, Vice President, American Zinc Sales Co. emphasized that "there will be sufficient Special High Grade available to the die casting industry to fill your requirements, not only in 1956, but also for the foreseeable future . . ."

In support of this, he quoted estimated consumption of 390,000 tons of Special High Grade slab for die casting, 70,000 tons by other consumers, making a total consumption of 460,000 tons. On the other hand, domestic smelters, he said, are now producing this metal at a rate of 385,000 tons per year, plus normal imports of 100,000 tons from Canada and small amounts from Belgian Congo and other sources, totaling approximately 510,000 tons by the end of 1956.

Among outside influences which have affected zinc pricing since 1951, according to Mr. Young's review, are government stockpiling, price controls and allocations followed by an adjustment period, the steel

Continued next page

The Next Five Years . . . How Much Metal Will Be Used For Die Casting?

	ZINC	ALUMINUM		
	Special High (Tons)	For Die Casting	For Zinc Alloy	Total
		(Millions of Pounds)		
1955	360,000	345	30	375
1956	385,000	405	30	435
1957	410,000	475	32	507
1958	440,000	545	35	580
1959	470,000	635	37	672
1960	500,000	760	40	800

American Die Casting Institute

ZINC—cont.

strike, flooding by distressed foreign material, and consequent build-up of stocks of slab zinc. Stocks have now been reduced to approximately 45,000 tons, he said, and "the zinc industry is in a more healthy situation than it has been for several years."

A possible new method of leveling out price fluctuations was suggested by Mr. Young in a proposal which drew considerable comment from die casters: That pricing deliveries of Special High Grade zinc be based on the previous quarterly average price. "If this method of pricing would be of benefit to the die casting industry by giving . . . a known price for zinc for a three-month period, it might be possible for some zinc producers to acquire concentrates on this same method of pricing . . . such a method would tend toward a more stabilized market . . . and would eliminate some of the speculative risk which now exists."

ALUMINUM

David Laine, Secretary, the American Die Casting Institute, told the meeting that the die casting industry is not receiving an adequate supply of aluminum casting ingot, if the word "adequate" is defined as "an assured supply at economically competitive levels."

Emphasizing the gravity of the situation, Mr. Laine made these points: 1.) The price of secondary aluminum is higher than the price of primary, indicating shortage of supply; 2) Since price quotations for die castings are determined by estimating formulas in which metal cost is a major element, competitive ability may be adversely affected; 3) In a growth industry where accelerated technological development indicates continued increase in use, insecurity of metal supply can endanger the industry's future.

Robert K. Beck, President, Apex Smelting Co., showed tabulated figures to demonstrate that "the die casting industry's percentage of growth is more than 2½ times that of the overall aluminum wrought products industry." Between 1948 and 1955, shipment of aluminum die castings is up by 179 percent, compared with shipments of wrought products up 70.7 percent and all types of castings up 73.7 percent.

He noted the close relationship of the die casting and aluminum smelting industries, since about 85 percent of die cast aluminum comes from secondary metal.

"Scrap, our raw material, operates in a free market," Mr. Beck said, "Its price and availability goes up and down according to the law of supply and demand, and it is easily affected by extraneous pressures upon it such as exports, toll and conversions, and other demand factors."

Analyzing the sources of raw material and some of the problems of supply, he told the group, "Scrap is generated from the fabrication of aluminum forms plus obsolescence . . . scrap cannot be stored in large quantities and must, therefore, be processed within a short period of time after generation . . . this . . . means that smelters must be in a position in lean periods of demand as well as in periods of high demand to process this scrap and hold ingot inventory for your consumption."

Mr. Beck placed responsibility for the unusually high price of secondary aluminum casting ingot on the fact that "customers of . . . ingot shapes are forced to resort to conversion deals to obtain a portion of their metal supply. This factor, coupled with the direct purchase of scrap by the primary producers, places a heavy strain upon the scrap market which is simultaneously feeling the effect of your increased needs."

E. R. Bergman, President, U. S. Reduction Co. presented a series of tables in support of his contention that there would be a small overage of supply over demand of aluminum casting ingot through 1960. "In each year," he said, "there is a safety margin of availability over need, but . . . this safety margin is thin and scrap export can more than offset it."

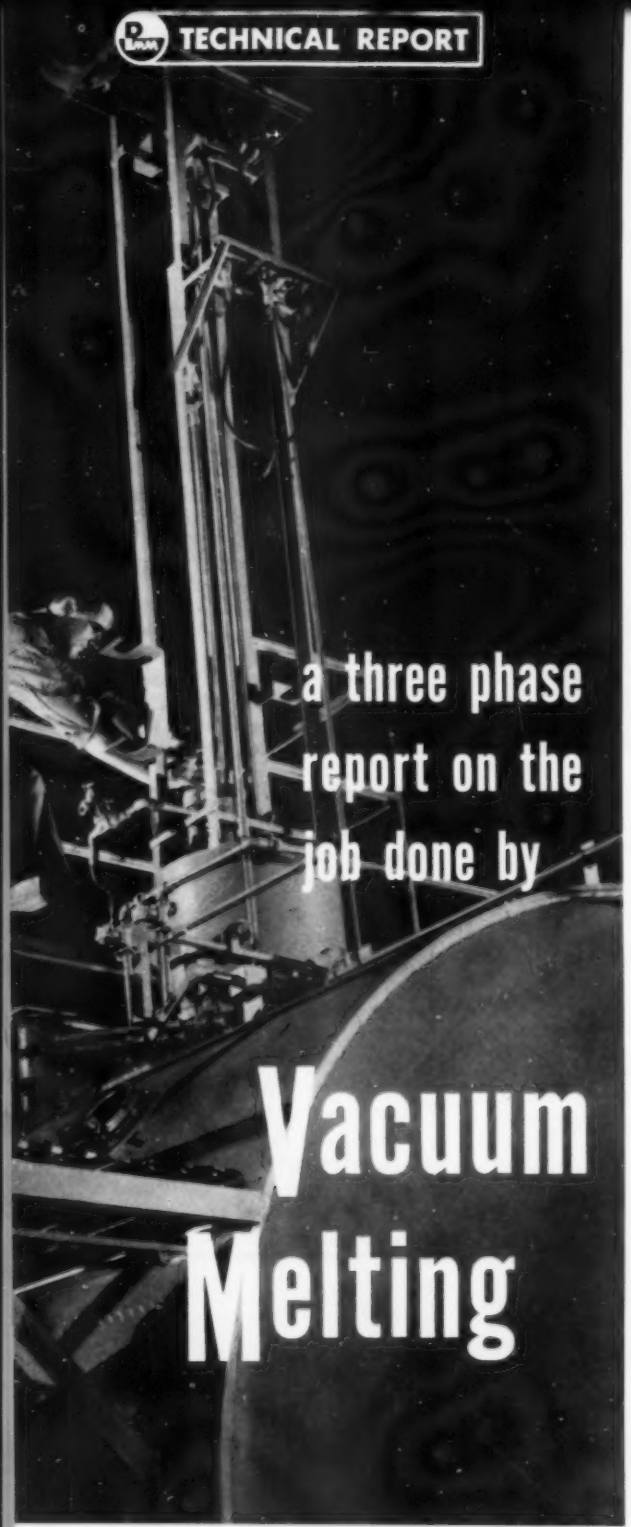
Looking into the future, Mr. Bergman predicted that this year's 360,000,000 pounds of aluminum die castings would increase by 1960 to about 760,000,000 pounds, a growth of 111 percent in the next five years, in addition to the 179 percent which the industry has grown since 1948.

Admitting that the margin of supply over demand is a narrow one, he pledged "complete cooperation in solving our mutual problems."

D. Wilmot, Vice President, Aluminum Company of America, promised to provide "a fair and equitable distribution of our available supply to *all* segments of industry," in response to the die casting industry's request for an increase in the amount of primary metal available to them.

Mr. Wilmot summarized the influences which should increase the total primary supply: the entry of several major companies into the field, possible reduction in government stockpiling demands, possible reduction in defense requirements for aluminum.

"Our records indicate," he said, "that interest in primary aluminum on the part of buyers of metal for the die casting industry has occurred principally in those periods when the price of secondary metal has been above the price of primary. It is thoroughly understandable. No one in industry presumably would use material of any higher quality or pay more for it than would be needed to fulfill the over-all requirements of strength, finish, etc. Because of these buying habits on your part, however, we, naturally enough, have cultivated other markets. Obviously it would not be feasible to withhold constantly large supplies of primary metal from the market in order that they would be available to a particular segment of industry when needed in crises."



a three phase report on the job done by Vacuum Melting

MELTING IN VACUUM may offer improved metals for high-performance investment castings.

1. Possible Tool For Investment Casting*

By JAMES H. MOORE,
General Manager
Vacuum Metals Corp.

DURING the past couple of years, the commercial development of vacuum melting and casting has been given considerable impetus. While this development has been confined to the production of wrought alloys, the vacuum melting technique merits serious consideration for shape casting as well.

The application of vacuum melting and casting to precision casting is not new to the laboratory. We have been using precision casting for the preparation of vacuum melted test specimens in alloy development programs since 1947 and more recently have begun investigating the commercial potential of the vacuum precision casting process. A typical furnace used in such evaluation work is one made by the Equipment Division of National Research Corporation, Figure 1.

This work has not yet reached a decisive point so far as commercial exploitation is concerned, and I feel, therefore, that we should refrain from quoting performance data until sufficient data for statistical study are available. However, it does appear appropriate to review the general characteristics and results of the process and expand somewhat on those of particular interest in precision casting.

When a melt is made in vacuum, the most obvious effect is, of course, the elimination of slag and dross effects from reaction of the melt components with the atmosphere. The solution of oxygen, nitrogen and hydrogen from the atmosphere is avoided. This one effect could be obtained from the use of an inert atmosphere, but a number of refining actions occur in the melt when it is exposed to a vacuum, as illustrated by Figure 2.

This generalized picture could represent an iron, nickel or cobalt melt. Hydrogen and nitrogen contents are reduced by the simple effect of vacuum in lowering solubility, and unstable gas-metal compounds decompose. The low pressure forces the reduction by carbon of oxides and dissolved oxygen, with the evolution of carbon monoxide. Likewise, any water vapor formed by the reaction of hydrogen with dissolved oxygen is pumped off.

On the negative side of the picture, some reactions with the crucible, or lining, of the furnace may be favored by low pressure, for example, the reduction of

*This report is based on a paper delivered before the Investment Casting Institute, April 1955.

Typical Melting Equipment . . .

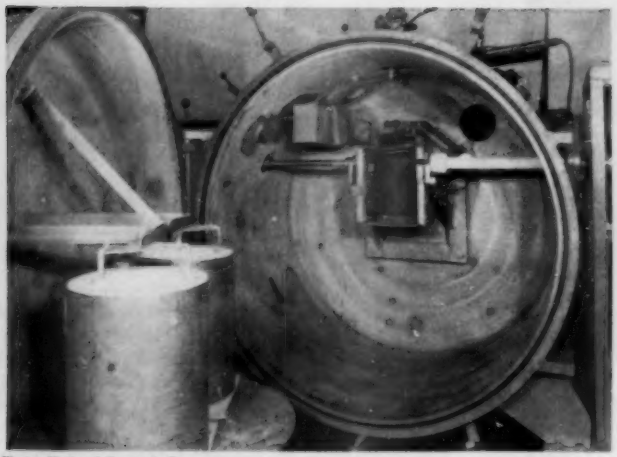
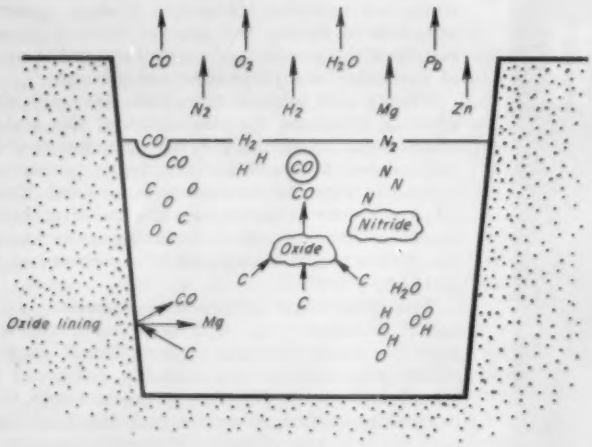


Photo: National Research Corp.

1. INVESTMENT CASTING FLASK is shown here mounted inside of vacuum furnace. This is typical of equipment used for development work on this process.

What Happens In The Melt . . .



2. REFINING ACTION of vacuum melting is diagrammed here, showing decomposition of unstable gas-metal compounds, reduction of hydrogen and nitrogen, reduction of carbon and removal of water vapor.

magnesia to form dissolved magnesium and dissolved oxygen or carbon monoxide. The volatile impurities, such as lead, zinc, cadium, bismuth, and magnesium, are evaporated from the melt.

A little more definition may be given to the picture of these effects. Figure 3 is a plot of the hydrogen and nitrogen contents in solution in molten nickel at 1580 C as functions of the pressure of the respective gases over the melt. The proportionality of dissolved gas content to the square root of the pressure clearly indicates the powerful effect of pressure on gas solubility.

The decomposition of certain oxides under low pressure is illustrated in Figure 4. At a furnace pressure of 10 microns (0.01 mm Hg.) it may be seen that copper oxide decomposes at the melting temperature of copper, and nickel oxide at the melting temperature for nickel. Iron oxide,

---

Experience with vacuum melting indicates that it should give the following advantages in investment casting.

1. Elimination of gases and their:
   a. Effects on dimensions and soundness of castings
   b. Effects on mechanical properties
   c. Effect on surface finish
2. Elimination of slag and dross
3. Elimination of residual elements causing hot shortness
4. Closer analytical control
5. Possibility of higher content of very reactive alloy components.

---

and the oxides of more stable melts do not decompose at this pressure and usual melt temperatures, and must be removed by carbon or hydrogen deoxidation.

The effect of reduced pressure on the carbon-oxygen reaction in molten chromium, a possible future base for cast high temperature alloy is shown in Figure 5. The equilibrium carbon and oxygen contents are shown to be a function of the residual pressure of CO over the melt.

The metals commonly used as alloy bases have low vapor pressures. Some of the metals which may be separated from them by

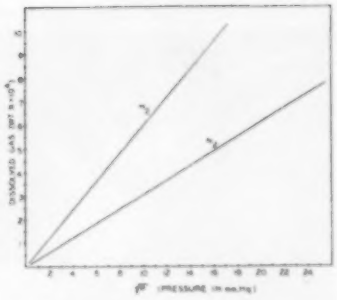
vaporization during vacuum melting, and their vapor pressures at the melting temperature of iron are as follows:

Chromium	1.5 mm
Manganese	16 mm.
Aluminum	19 mm.
Lead	260 mm.
Bismuth	greater than 1 atm.
Magnesium	greater than 1 atm.
Tellurium	greater than 1 atm.
Zinc	greater than 1 atm.
Cadmium	greater than 1 atm.

This vaporization effect can be a disadvantage when a controlled alloying addition of a volatile metal must be made prior to a vacuum degassing treatment. However, taking the case of chromium as an example, the loss is predictable under a certain set of conditions, and the required allowance for loss can be made.

The effectiveness of the vacuum refining of a nickel melt which might serve as the base for a variety of alloys such as high temperature alloys or electrical alloy is shown in Figure 6. Rapid elimination of nitrogen is evident, as well as the possibility of a very low oxygen if tapping is properly timed. The application of vacuum melting to iron alloys containing chromium has given comparative nitrogen contents shown in Figure 7.

The effect of gas content on casting dimensions due to gas formation during solidification is well known and of great importance in alloys which tend to be "gassy." The benefit from vacuum melting and casting is obvious, although one should add that incomplete degassification followed by casting in vacuum can give very bad porosity because of the reduced pressure head.



3. EFFECT OF PRESSURE on the solution of hydrogen and nitrogen in nickel at 1580 C.

Continued on page 96

2. How It Improves Metals*

1. Nickel and Cobalt Base Alloys

Nickel and cobalt based alloys benefit through vacuum melting because there is a minimum loss of hardening elements due to oxidation. Their superior cleanliness is reflected in substantially improved fatigue and stress rupture properties.

Ductility and overall workability are greatly improved so fewer scrap parts are produced. In addition, vacuum melted scrap itself has an excellent remelt value.

As an example, in converting expensive high temperature alloys produced by conventional melting practices from ingot to bar stock, a 40 to 50 percent recovery was the average obtainable. With vacuum melted carboloy alloy M-252, the average recovery now obtainable is 60 to 70 percent. For composition see page 98.

The bar scrap produced is much cleaner and its hardening elements are undiluted by oxidation. It can, therefore, be remelted in the vacuum furnace without appreciable loss of properties and without the necessity of making major alloy additions.

The improved mechanical properties obtainable with these alloys will allow jet engines to be operated at higher temperatures, thereby increasing the efficiency of their performance. In addition, vacuum melting permits the manufacture of high temperature alloys with substantially larger amounts of hardening elements than is feasible by air melting practices. This promises to create a new family of high temperature alloys with even better mechanical properties.

Alloy J-1570 is an excellent example, and there are others even more promising under development by the Carboloy Department which will be made available for high temperature applications.

2. Low Alloy Steels

Vacuum melting imparts superior cleanliness, fatigue strength and transverse mechanical properties to low alloy steels.

3. High Chromium Alloys

High chromium alloys, like 430 and 446 stainless, normally exhibit brittle fracture at room temperature. As a result their impact strengths are too low for many applications. Vacuum processing has enabled production of these alloys with a substantially lower transition temperature and consequently a greatly improved room temperature impact strength. This will extensively broaden their field of use.

4. Copper and Nickel

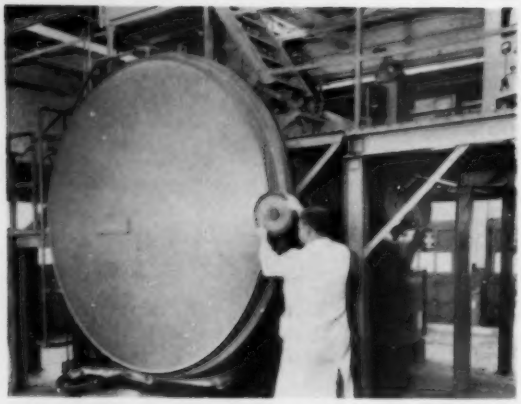
Reduction of their dissolved gases greatly improves these materials for use in electronic tube applications. The emission characteristics of cathodes made from vacuum processed metal are superior because of their increased purity and closer control of composition. Vacuum melted copper has exhibited a conductivity very close to 100 percent of the calculated theoretical value.

5. Iron

The purity of iron is greatly increased by vacuum processing. This type iron has been shown to have a 60 to 75 percent greater resistance to rupture. Elongation has often been increased as much as 400 percent with comparable

Continued on page 98

*Material is based on data from Technical Bulletin VM-101, Carboloy Dept., General Electric Co.



UNLOCKING THE DOOR of the vacuum furnace. Horizontal layout of furnace and full-diameter door give complete access to interior.

Photos: F. J. Stokes Machine Co.

REMOTE CONTROL WHEEL pours a 200-lb. melt. W. L. Weddle, research engineer, can watch progress of the pour through sight-glass.

3. Case Study: Thompson Products Inc. Installs Furnace For Research And Development

ONE of the largest suppliers of aircraft and automotive components, ranging from poppet valves to piston rings and from jet turbine engine vanes and blades to complex fuel systems has turned to vacuum metallurgy for help in developing new high-purity metals that will make tougher and longer-lasting components, and new methods of forming that will improve and simplify its production and lower its costs.

Under the direction of K. M. Bartlett, manager of research, Thompson Products, Inc. has been actively exploring many potential uses for vacuum-processed metals. Such metals, melted and cast completely under vacuum, are free of nonmetallic contamination and dissolved gases and, as a result, their mechanical properties are markedly increased.

At the present time Thompson's activity is directed principally to the improvement of high temperature alloys currently used for gas turbine engines by the use of vacuum and inert gas atmosphere melting and casting. In the not-too-distant future, activity will be directed toward the development of new alloys whose compositions present difficult or insurmountable problems with air melting and casting conditions.

The techniques of vacuum melting and casting are quite involved and complicated by chemical reactions which do not occur under non-vacuum conditions, giving rise to scores of technical inquiries in high temperature chemical reactions.

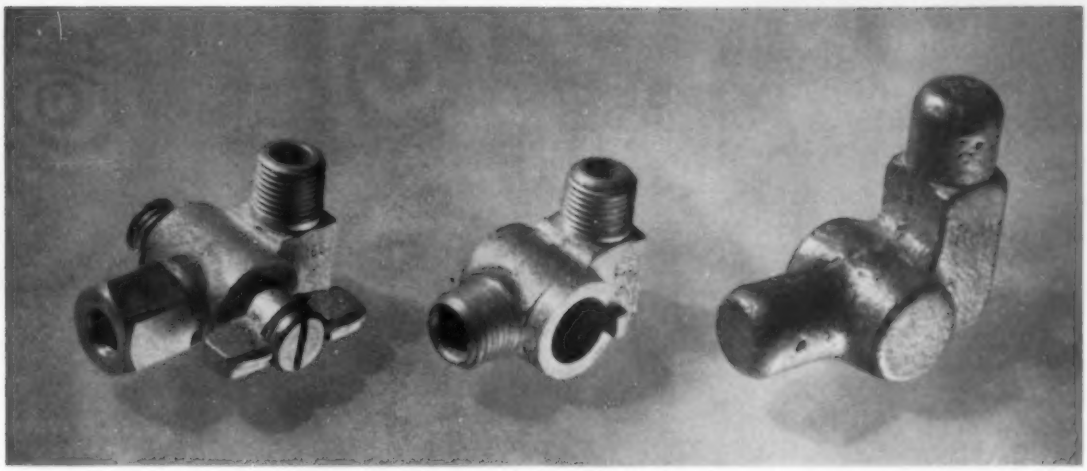
From work to date it appears reasonable to conclude that the vacuum processing of current production high temperature alloys will make large percentage improvement in both endurance limit and ductility levels. Increased ductility and higher endurance limits are extremely important contributions to the materials aspect of turbine engine operation.

Investment casting, by which intricate shapes are obtained without machining, has been done experimentally under vacuum conditions by Thompson Products' research engineers as part of their evaluation of improved forming methods. This procedure is expected to find considerable application for economical production of jet engine turbine parts.

To assist in this research program, Thompson Products recently installed in its Cleveland research laboratory a Stokes Model 437 vacuum furnace in which vacuum-melted and cast alloys are produced in 200-lb. batches. The furnace, 8 ft. in diameter and 10 ft. long, has a large internal volume, so that it can be modified to handle 1000-lb. melts whenever the company is ready to embark on large-scale production.

Test specimens of various experimental compositions of metals and alloys are cast in the furnace. These are examined for creep, resistance to thermal shock, and other characteristics. Vacuum-melted metals have shown vastly improved resistance to the destructive effects of high temperatures due to their purity and homogeneous structure.

Outstanding feature of this vacuum furnace is its large-capacity pumping system, utilizing two 10-in. Stokes booster pumps and a Microvac fore-pump, capable of handling 60,000 micron cubic feet per minute, at a pressure of 10 microns. This large pumping capacity is needed for handling the tremendous volume of out-gasing that occurs when melting and de-gassing these high-temperature alloys.



1. FROM SAND CASTING, right, to shell mold casting, center, is the success story of this shut-off-valve for gas lines, left. Besides eliminating porosity as a source of rejects, the shell casting also reduces machining, cuts inventory requirements and gives lower finished piece cost.

COVER STORY

2. MINUTE AND FIVE SECONDS is the average cycle for producing combined cope and drag shells in this mold making machine. Medium cure resin is employed.

RED BRASS FITTINGS: they're sound when cast in shells

USE of red brass shell mold castings for a widening range of small-to-medium-sized fittings in the heating, plumbing and allied fields seems indicated by current experience of W. J. Schoenberger Co. of Cleveland, manufacturers of valves and fittings for gas appliances.

For many years, this company has obtained sand cast components in brass from Standard Brass Foundry Co. Three years ago, this jobbing foundry set up a small shell mold casting department and ran pilot quantities experimentally in red brass.

When satisfactory foundry practices had been established for this difficult-to-cast metal, some pieces that seemed especially well

Here's what a designer and a foundryman say . . .

D. D. BURNSIDE, Chief Design Engineer, Schoenberger Co., a past national president of the American Society of Tool Engineers, says, "Shell mold casting has given us a better product at lower finished price. Better still, it has virtually eliminated porosity rejects and their effect, not only on direct costs, but also on production schedules."

M. WOLF, President, Standard Brass Foundry Co., says, "This experience has given us confidence that shell casting has a far greater future than was ever perceived in the past. It convinces us that there are virtually no engineering limitations to this process, applicable to both ferrous and non-ferrous metals, especially where a product having high density is required."

RED BRASS VALVE—cont.

suited to shell mold casting were converted to this process. Now, Standard is producing several such items in substantial commercial quantities.

Typical of this group is the body of a shut-off valve, Figure 1, for use on gas lines to water heaters and stoves. Previously, Schoenberger had the piece produced by sand casting, disadvantages of which have now become apparent by comparison with shell mold casting.

With either process, a basic solid casting is drilled and bored from each end of the right angled casting, so that the perpendicular holes meet to form an opening all the way through. Similarly, a cross hole is drilled to receive the valve stem, and one face of this hole is machined to produce a check nub which limits the distance the stem may be turned. In both types of castings, opposite ends of the casting are threaded.

Now that more than 20,000 of these parts have been produced in shell molds, the company finds these advantages:

1. Porosity has been virtually eliminated as a source of rejects.
2. Amount of machining has been greatly reduced.
3. Inventory requirements are lower.
4. Less metal goes into each casting, and less metal is lost in chips.
5. Finished piece costs are lower, even though costs per pound of new castings and cost of patterns are higher.

Here, in greater detail, are the findings based upon experience with shell mold castings of this valve body having relatively simple shape.

Probably the outstanding improvement in quality has been the obtaining of dense, sound castings that contain no blow holes or voids to be discovered when holes are drilled through the piece. The self-venting characteristics of the resin-bonded shell mold are credited with this, for the resin burns out when the molten metal is poured, leaving a highly permeable shell that releases entrapped gases.

This freedom from porosity is also responsible, in large measure, for the lower finished piece cost of shell mold castings. When these fittings were sand cast, greatest single cause of rejects was internal porosity. Unfortunately, this type of defect does not show up until *after* expensive machining has been put into the piece. While the metal can be salvaged, the most expensive element . . . the labor . . . is lost completely.

In designing a sand casting, extra metal has to be allowed for finish, since both rough and finish cuts are needed wherever dimensions must be accurate. The abrasive outer skin, for example, had to be cut away before either end of the casting could be threaded. Also, a great deal of extra stock is allowed usually to compensate for possible mismatching or other inaccuracies that occur in sand casting. These are eliminated in shell mold casting, since the mold halves are accurate, smooth and perfectly registered together.

When foundry engineers prepared to retool this job from sand to shell mold casting, they asked Schoenberger for forging drawings, rather than the original sand casting drawing, because they wanted to work as close as possible to finished dimensions.

The advantages of shell molding for the product are further apparent when this process is compared to the possible alternative of forging.

If the forging process were used it would be necessary for Schoenberger to load up inventory with at least a six-month supply in order to justify the cost of a forging set-up. In contrast, shell-molding can be economically applied to relatively small batches; even a one-day run is practical. Conversion from one product to another, in this case, is a job that can be accomplished in as little as 20 minutes.

As a final cost-saving item, the shell molded components lead to economies in tool wear as compared, in this instance, either to sand casting or forging.

In the shell molding process, as applied by Standard, the molds are made of a mixture of sand and Durez resin of medium-cure grade. They are formed on a cope and drag in a Shell-O-Matic machine at an average cycle of 65 seconds.

Each mold for the valve body provides for the simultaneous casting of 36 units, and this company usually fills from six to 15 molds at each pouring, although the number could be increased.

Pouring temperature of the molten red brass is a critical factor. For the valve parts, a temperature of 2100 F is chosen, but it varies for other products and for other grades of plastic mold materials. This temperature is held within extremely close limits.

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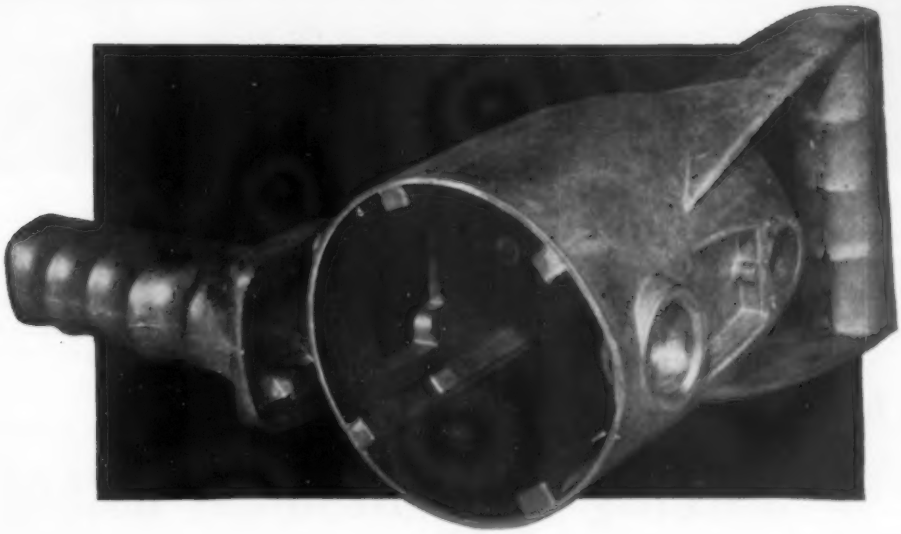

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CLOSELY CONTROLLED melting techniques are important in preparing master alloy for investment casting. Shown above is a furnace at the plant of Cannon-Muskegon Corp.

Six factors to consider in

Selecting Your Investment Casting Alloy

By **F. KENNETH IVERSON,** Metallurgist
and **J. B. MEIERDIRKS,** Sales Engineer
Cannon-Muskegon Corporation

THE investment caster is faced with an increasing variety of alloys required by his customers. In addition to handling the many complex problems of investment casting, it is necessary for him to have a full knowledge of:

A. The selection of appropriate alloys

B. The procurement of satisfactory raw materials

C. Adequate melting and deoxidation procedures

*Castability: Its Effect On Alloy Selection, W. A. Dubovick, PMM June, July 1955.

The techniques and problems of alloy selection were covered in a recent article*. The present article will be concerned with the factors influencing the procurement of satisfactory raw materials.

The investment casting raw material is important since it influences the efficiency of the melting operation and the quality of the casting. In the selection of a raw material the following factors must be considered: 1. Analysis; 2. Form; 3. External cleanliness; 4. Metal purity; 5. Availability; 6. Metal cost.

1) **Analysis.** Selecting alloys for remelt on the basis of standard chemical specifications is inadequate to meet the needs of investment casting. After remelting, such materials may not have the chemical analysis or properties required.

In order to meet specification requirements in the final casting and for effective processing, the composition of the raw material must allow for:

a. Losses or gains in composition during melting

"Exacting Analysis Is Probably The Most Important Single Feature . . ."

b. Allowances for deoxidation when used

c. The influence of composition on castability

d. The optimum composition for good properties

As an example, the Aeronautical Material Specification (AMS) 535OC, for 410 stainless steel has the following limits:

C .05-.15	Mo .50 max
Mn 1.0 max	Cu .50 max
Si 1.0 max	P .04 max
Cr 11.50-13.50	S .03 max
Ni .50 max	

If this material is melted in a small induction furnace, there would be a carbon loss of .02 to .05%, a silicon loss of .05 to .20%, and a manganese and chromium loss of approximately .05 to .15%. The exact percentage of loss is dependent upon melting time and temperature. With an arc furnace, there would generally be a carbon pickup of .02 to .05%, rather than a carbon loss. The losses in chromium, silicon, and manganese would be about the same.

The investment caster melting Type 410 in induction equipment, with little or no deoxidation, requires material with carbon .11 to .15% and chromium, silicon and manganese on the high side of the range. Without these qualifications he may not be able to meet the specifications after remelting and may have difficulty with his castings because of low silicon and manganese. These elements effect the fluidity of molten metal and its gas content.

Some investment casters adjust the composition of raw materials py making small additions during melting. This is somewhat difficult because it is necessary to recalculate the additions for each lot of material and to rely on the melter to make the small additions consistently and accurately. Consequently, it is desirable for the inpestment caster to determine what chemical limits he requires, and obtain material within these limits.

During the last several years, the investment caster has come to realize the value of some deoxidation prior to pouring. The analysis of the raw material must also be considered in view of the allowances for deoxidation. The 5350C material with silicon .90 to 1.00 is within the specification but leaves litfle or no room for adequate deoxidation with ferro silicon. Consequently, a lower silicon range should be selected if deoxidation is used.

The chemical analysis of the raw material also determines, to some extent, the properties of the final casting. With the 410 material, the hardness after heat treatment can be markedly changed by the adjustment of the carbon, chromium, and silicon concentrations within the specifications.

In addition to all the above requirements, the investment caster must be sure that the analysis is completely reliable and that the material is representative of this analysis from beginning to end. An exacting analysis is probably the most important single feature of the raw material used in investment casting.

"Ease Of Handling And Melting Are Influenced By The Form . . ."

2) **Form.** Other factors remaining equal, the exact raw material form is important in respect to melting and handling. There are five forms of raw material available to investment casters: a) Shot, b) Small cast billets, c) Bar stock clippings, d) Ingots, e) Scrap.

With induction furnaces of small capacity and high frequency, shot is certainly the most advantageous form to use from both a handling and a melting standpoint. The material is convenient to weigh and charge into the furnace. The large surface area to weight ratio provides rapid melting. In the past there has been some dfficulty with small explosions of shot due to the entrapment of water inside the shot. The producers of shot have continually perfected techniques to the point where the occurrence of shot explosions has been greatly reduced and with some further improvement will be practically nonexistent.

With larger type furnaces, large forms such as billets, bar stock clippings and ingots are sometimes preferred. The larger furnaces generally have lower frequencies and sufficient heat penetration to use these forms advantageously.

In the use of scrap, the form is likely to vary with each purchase. Consequently, the investment caster should know exactly what form the scrap is in before he purchases the material so that he can estimate cost of cutting up and cleaning prior to charging.

"All Types Of Surface Contamination Should Be Avoided . . ."

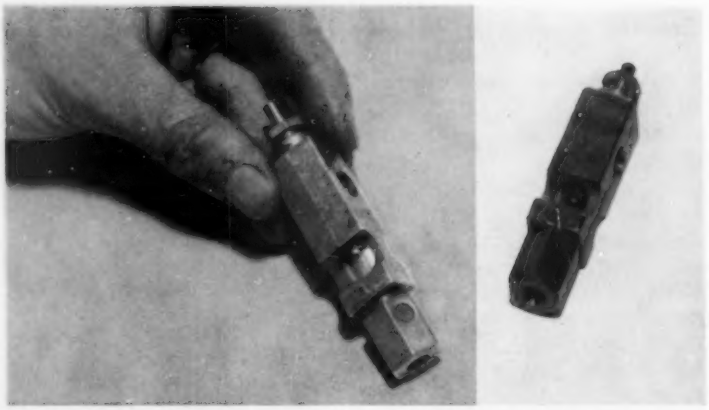
3) **External Cleanliness.** The raw material for investment casting should always be evaluated from the standpoint of oxide scale, slag, oil or other contaminants which would cause difficulty with melting or analysis.

In the case of ingots, billets or scrap, oxides or other surface contamination can be removed by shot blasting, of course, at added cost to the investment caster. When using shot the investment caster must rely on the supplier to provide material externally clean because few investment casters have facilities for washing, polishing or drying material in this form.

In preparing remelt alloys it is more difficult to eliminate slag completely from ingots or billets than from shot. Slag which is allowed to pass into the ingot or billet mold becomes inevitably a constituent in the product suppiled to the investment caster. In the case of shot, if a small amount of slag is poured with the metal it is removed during the screening operation.

Continued on page 85

Can You Replace Brass Bar Stock?



SAVINGS OF 48 PERCENT resulted when this zinc alloy die casting . . . replaced a brass piece turned from bar stock.

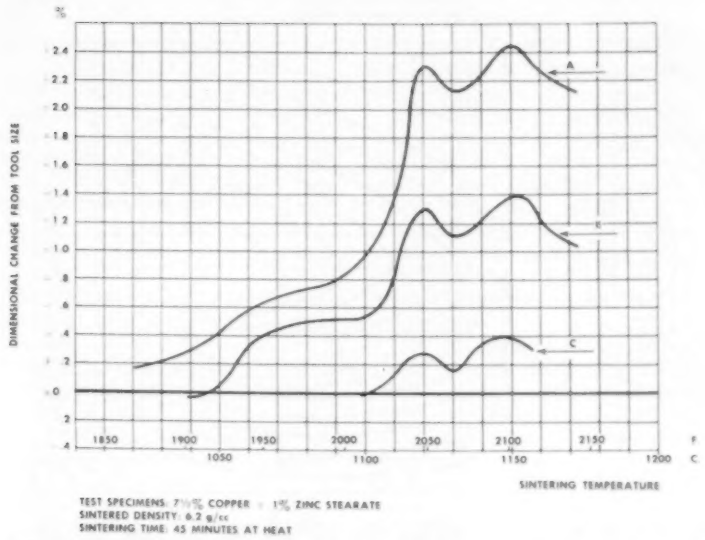
REDUCED cost, increased dimensional accuracy and improved performance have been achieved in a cylinder vapor lubrication unit for internal combustion engines through extensive use of zinc die castings. The four major metal components as well as a series of six adaptor plates are die cast of zinc alloy.

The unit built by U. S. Aviex Co., Niles, Michigan supplies motor tune-up oil in vapor form through an adaptor plate which mounts between the carburetor and intake manifold. Since the oil is drawn into the engine by vacuum, density and pressure tightness of all components are prime considerations.

The cover for the glass jar (which also serves as mounting bracket for the unit) must have a full internal thread to insure a tight fit. This ruled out the possibility of a stamping for this part since stampings cannot be produced with a full thread. The bracket and cover are cast as a single piece (a) with the coarse internal thread cast-in through use of a removable core. The filler cap (B) is also a zinc die casting which has cast-on external threads. Thread chasing is the only operation required for the filler cap following die casting.

The flow control valve (C) was originally machined from brass bar stock. Production by this method was costly and time-consuming. In addition, the brass allocation program made procurement a problem. The die caster, Hermel Die Casting Co., suggested that zinc die casting be attempted despite the need for expensive dies.

BETTER THAN STAMPINGS, the die cast zinc components for this vapor lubricator include the ten pieces shown above.



1. DIMENSIONAL CHANGE vs sintering temperature for three different iron powders is shown. Two maxima surrounding a minimum in the popular temperature range of 2050 to 2100 F is characteristic.

BY P. ULF GUMMESON & LENNART FORSS
Hoeganaes Sponge Iron Corp.

How Dimensions And Properties Are Affected By

Adding Copper To Iron Powder Compacts

IT is a known fact that iron powder compacts assume quite different dimensional changes when additives are used. Especially is this the case when copper powder is added. For most iron powders, the ultimate dimensions are larger when mixed with copper powder as compared to the plain iron part. We normally refer to this phenomenon as *copper growth*. It should be mentioned here, that some powders do not show this property and others might even show a copper shrinkage. It will be shown that although most commercial iron powders behave in different ways, there is a definite relationship between them.

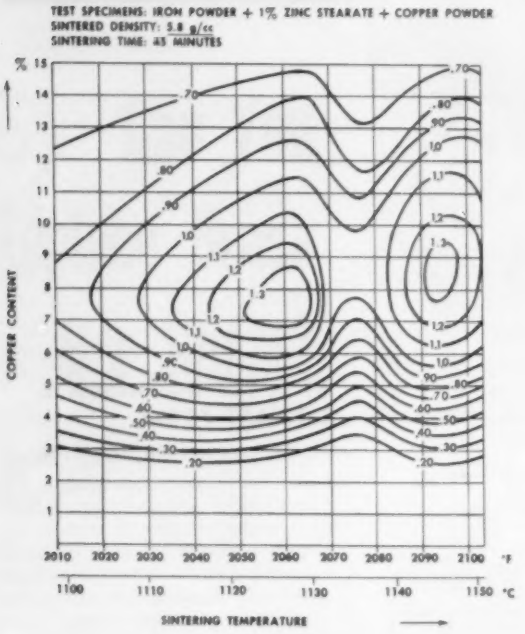
Test Results

Figure 1 shows in a graphical form a simple comparison among three different commercial grade reduced iron powders and the effect of sintering temperature on dimensional changes when 7½ percent copper is added. The test specimens were rectangular bars, 1.25" x .500" x .250". The copper powder was of the reduced type with maximum 100-mesh particle size. Sintering time was 45 minutes at heat under hydrogen atmosphere. Dimensions were calculated from tool size. Unless otherwise stated, all following tests were also made under these conditions.

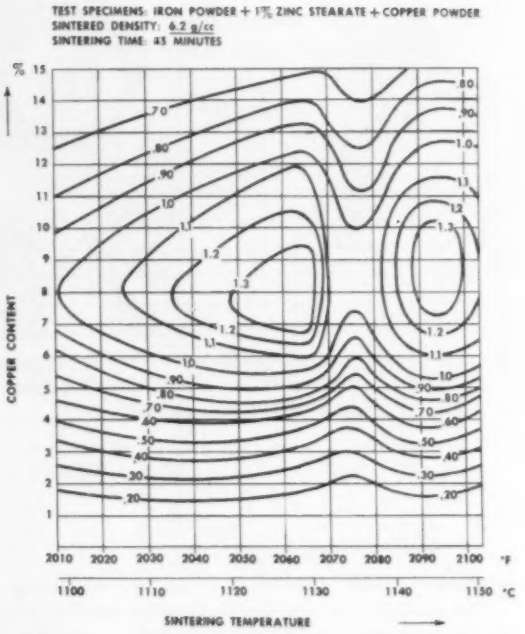
In the most frequently used temperature ranges we find that the so-called copper growth ranges between 0 and 2½% or 0 to .025 inches/inch. Of special interest are the typical 2 maxima surrounding a minimum, a phenomenon that we find more or less accentuated for all the various iron powders, that have been investigated, not only of the reduced type.

It is interesting, not only because it is difficult to explain, but also because it has an influence on the production problems considering the fact that dimensional control will be so closely linked to rigorous temperature control. If, for example, sintering is done between 2050 F and 2100 F, the dimensions of the part will be influenced by temperature variations much more than if the minimum were not present.

Dimensional change as a function of sintering temperature and copper content.

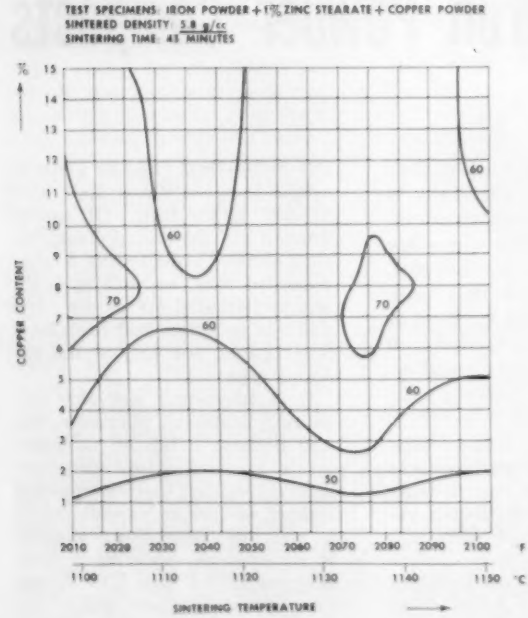


2. Iron plus copper, sintered to 5.8 g/cc density.

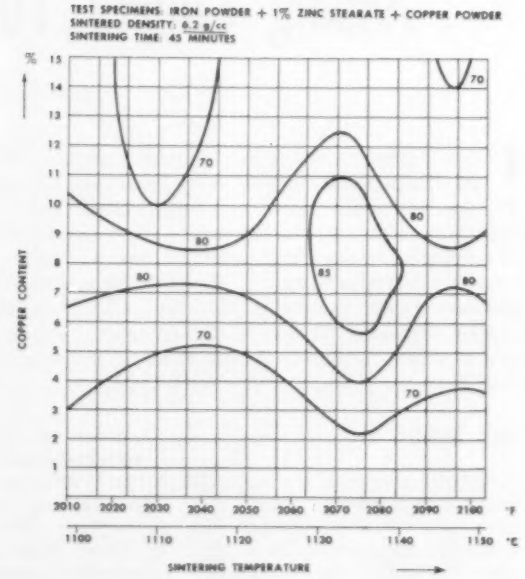


3. Iron plus copper, sintered to 6.2 g/cc density.

Change in traverse rupture strength as a function of sintering temperature and copper content.



4. Iron plus copper, sintered to 5.8 g/cc density. Shown as psi x 10^3.



5. Iron plus copper, sintered to 6.2 g/cc density. Shown as psi x 10^3.

ADDING COPPER TO IRON — cont.

A series of tests was run with B iron powder to illustrate the influence of both copper content and sintering temperature on dimensions, strength and hardness. Parts with two different densities were included in the tests. Results are reported in Figures 2, 3, 4, 5, 6 and 7. It should be mentioned, that so many factors influence the results, that they should be interpreted as pattern of trends rather than specific properties.

In Figures 2 and 3, we again recognize the maxima and the minimum for dimensions at sintering temperatures between 2050 F and 2100 F, at copper contents between 7 and 9 percent. It is interesting to note that this is approximately the solubility limit of copper in gamma-iron.

Dimensional control is closely linked to temperature control and control of copper content. The influence of these factors on dimensional variations, of course, increases with the steepness of the "slopes" in the graph. As an example, we would expect rather good dimensional stability with a copper content of 8 percent and sintering temperature of 2050 F, but less stable results if sintering is done at 2070 F with copper content of 6 percent.

The graphs further show that the same dimensions can be expected for a variety of different copper contents and sintering temperatures.

Figures 4, 5, 6 and 7 show transverse rupture strength and hardness as functions of copper content and sintering temperature. Here, it is interesting to note that maximum strength and maximum hardness occur under conditions represented by the area between the two maxima for dimensions.

We further find, that a certain strength or hardness can be obtained under widely different conditions. Influence of sintering temperature on strength and hardness is generally less than on dimensions. Increasing copper contents increase the strength only when the solubility limit of copper in gamma-iron is not reached.

For the above described investigations, the number of variables as far as possible have been held at a minimum. Here is an outline of the influence upon dimensional changes of some of the most important variables:

1. *Sintered density.* As can be seen from Figures 2 and 3, sintered density has a rather modest influence on dimensional change, especially at higher copper contents and higher sintering temperatures. Generally speaking, one can expect somewhat increasing dimensions with increasing density.

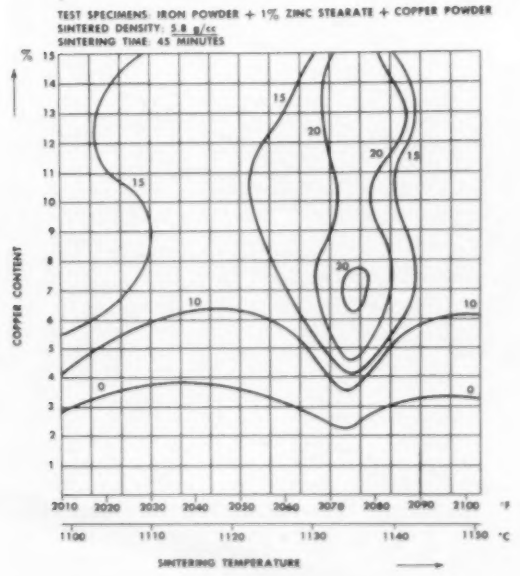
2. *Sintering time.* Test specimens from B-iron with 7½ percent copper and 1 percent zinc stearate were pressed to density 6.2 g/cc. Figure 8 shows that only very short sintering times (below 10 minutes of heat) have a great influence on copper growth. Prolonged sintering times mean somewhat smaller dimensions. In this test, time to reach temperature was less than two minutes.

3. *Heating rate.* The time it takes the specimens to reach sintering temperature has an influence on ultimate dimensions. This is illustrated in Figure 9. Test specimens from B-iron with 7½ percent copper and 1 percent zinc stearate were pressed to density 6.2 g/cc. The specimens were put in the furnace, which was held at different starting temperatures.

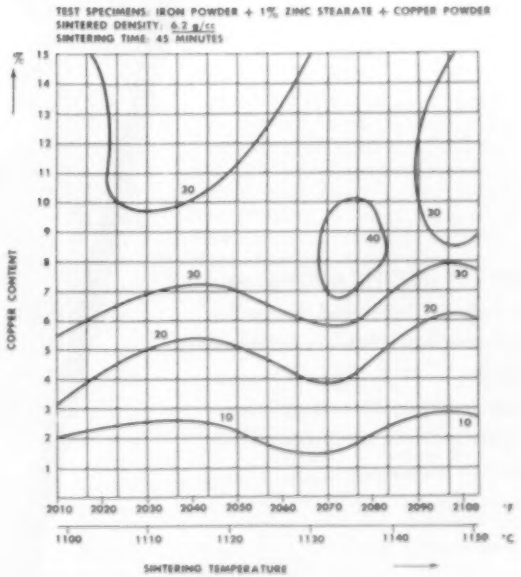
Following this, the furnace

Continued on page 92

Variations in hardness as a function of sintering temperature and copper content.



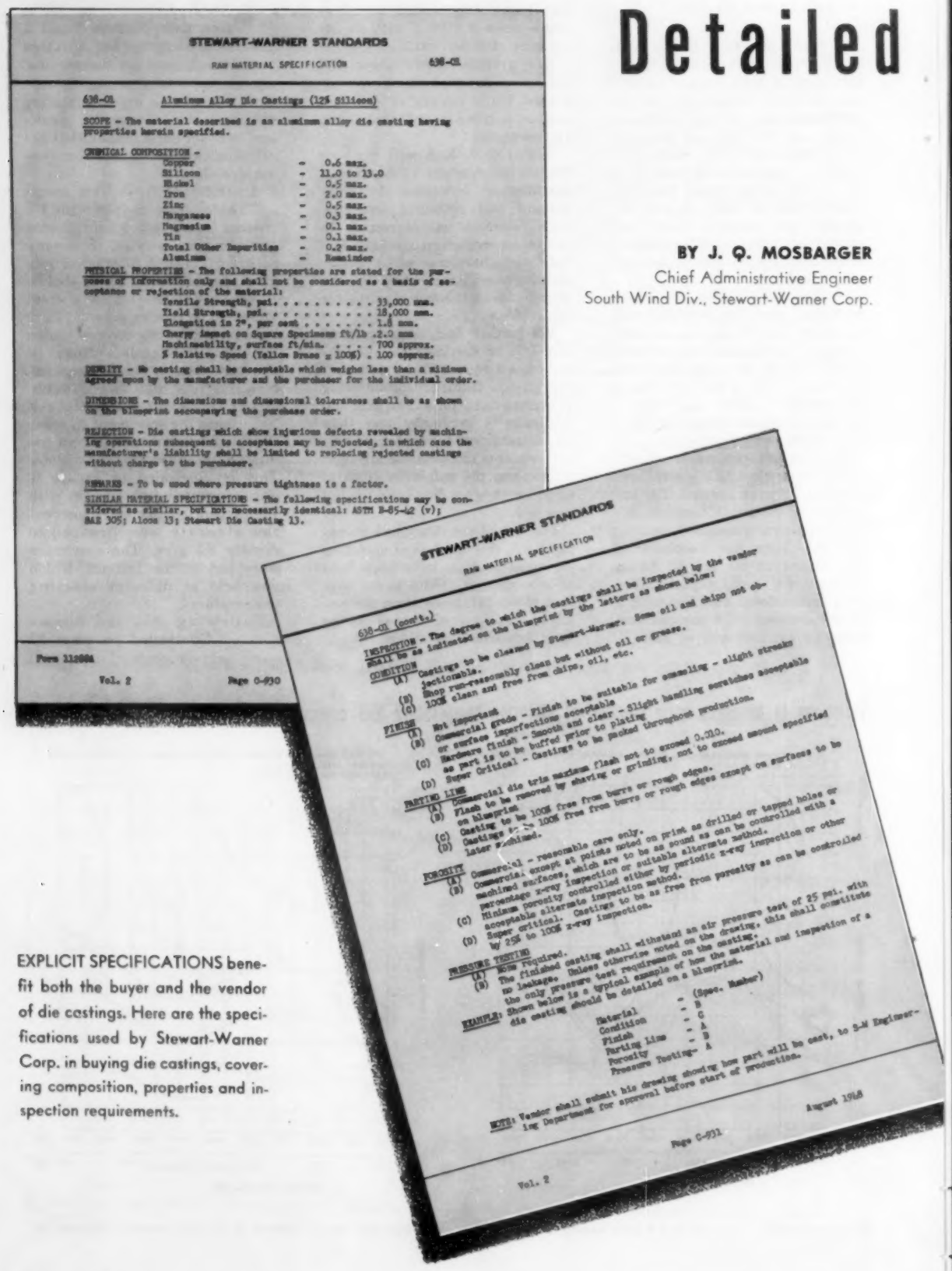
6. Iron plus copper sintered to 5.8 g/cc density. (Rockwell B)



7. Iron plus copper sintered to 6.2 g/cc density. (Rockwell B)

Detailed

BY J. Q. MOSBARGER
Chief Administrative Engineer
South Wind Div., Stewart-Warner Corp.



STEWART-WARNER STANDARDS

RAW MATERIAL SPECIFICATION 636-CL

636-CL Aluminum Alloy Die Castings (12% Silicon)

SCOPE - The material described is an aluminum alloy die casting having properties herein specified.

CHEMICAL COMPOSITION -

Copper	-	0.6 max.
Silicon	-	11.0 to 13.0
Nickel	-	0.5 max.
Iron	-	2.0 max.
Zinc	-	0.5 max.
Manganese	-	0.3 max.
Magnesium	-	0.1 max.
Tin	-	0.1 max.
Total Other Impurities	-	0.2 max.
Aluminum	-	Remainder

PHYSICAL PROPERTIES - The following properties are stated for the purpose of information only and shall not be considered as a basis of acceptance or rejection of the material:

Tensile Strength, psi.	33,000 min.
Yield Strength, psi.	18,000 min.
Elongation in 2", per cent	1.5 min.
Charpy impact on Square Specimens ft/lb	2.0 min
Machinability, surface ft/min.	700 approx.
% Relative Speed (Yellow Brass = 100%)	100 approx.

DENSITY - No casting shall be acceptable which weighs less than a minimum agreed upon by the manufacturer and the purchaser for the individual order.

DIMENSIONS - The dimensions and dimensional tolerances shall be as shown on the blueprint accompanying the purchase order.

REJECTION - Die castings which show injurious defects revealed by machining operations subsequent to acceptance may be rejected, in which case the manufacturer's liability shall be limited to replacing rejected castings without charge to the purchaser.

REMARKS - To be used where pressure tightness is a factor.

SIMILAR MATERIAL SPECIFICATIONS - The following specifications may be considered as similar, but not necessarily identical: ASTM B-85-42 (v); SAE 305; Alcoa 13; Stewart Die Casting 13.

Form 11280A

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STEWART-WARNER STANDARDS

RAW MATERIAL SPECIFICATION

636-CL (cont'd.)

INSPECTION - The degree to which the castings shall be inspected by the vendor shall be as indicated on the blueprint by the letters as shown below:

CONDITION
(A) Castings to be cleaned by Stewart-Warner. Some oil and chips not objectionable.
(B) Shop run-reasonably clean but without oil or grease.
(C) 100% clean and free from chips, oil, etc.

FINISH
(A) Not important
(B) Commercial grade - Finish to be suitable for enameling - slight streaks or surface imperfections acceptable
(C) Hardware finish - Smooth and clear - Slight handling scratches acceptable as part is to be buffed prior to plating
(D) Super Critical - Castings to be picked throughout production.

PARTING LINE
(A) Commercial die trim maximum flash not to exceed 0.010.
(B) Flash to be removed by shaving or grinding, not to exceed amount specified on blueprint
(C) Casting to be 100% free from burrs or rough edges.
(D) Castings to be 100% free from burrs or rough edges except on surfaces to be later machined.

POROSITY
(A) Commercial - reasonable care only.
(B) Commercial except at points noted on print as drilled or tapped holes or machined surfaces, which are to be as sound as can be controlled with a percentage x-ray inspection or suitable alternate method.
(C) Minimum porosity controlled either by periodic x-ray inspection or other acceptable alternate inspection method.
(D) Super critical. Castings to be as free from porosity as can be controlled by 25% to 100% x-ray inspection.

PRESSURE TESTING
(A) None Required.
(B) The finished casting shall withstand an air pressure test of 25 psi. with no leakage. Unless otherwise noted on the drawing, this shall constitute the only pressure test requirement on the casting.

EXAMPLE: Shown below is a typical example of how the material and inspection of a die casting should be detailed on a blueprint.

Material	- (Spec. Number)
Condition	- B
Finish	- C
Parting Line	- A
Porosity	- B
Pressure Testing	- A

NOTE: Vendor shall submit his drawing showing how part will be cast, to S-W Engineering Department for approval before start of production.

August 1948

Page C-931

Vol. 2

EXPLICIT SPECIFICATIONS benefit both the buyer and the vendor of die castings. Here are the specifications used by Stewart-Warner Corp. in buying die castings, covering composition, properties and inspection requirements.

Specifications...

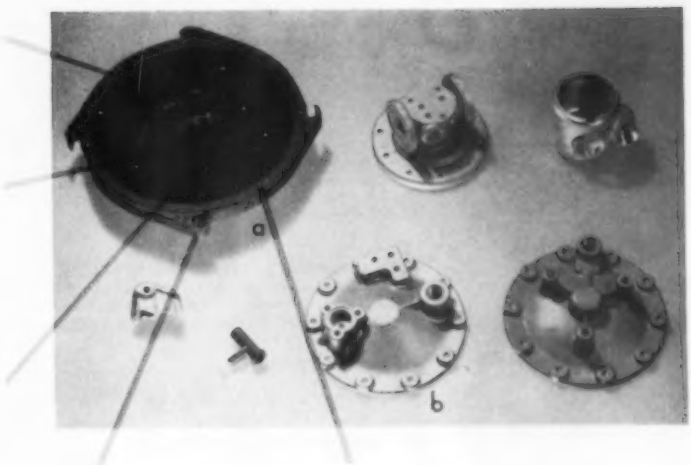
DIE CASTINGS

They will help you in buying die castings

CONDITION A—castings to be cleaned by Stewart-Warner. Some oil and chips not objectionable.

PRESSURE TESTING B—the finished casting shall withstand an air pressure test of 25 psi, with no leakage, unless otherwise noted on the drawing, this shall constitute the only pressure test requirement on the casting.

POROSITY B—commercial except at points noted on print as drilled or tapped holes or machined surfaces, which are to be as sound as can be controlled with a percentage X-ray inspection or suitable alternate method.



FINISH B—commercial grade—finish to be suitable for enameling—slight streaks or surface imperfections acceptable.

PARTING LINE B—flash to be removed by shaving or grinding, not to exceed amount specified on blueprint.

IN both the parent company and through its many manufacturing divisions, Stewart-Warner Corp. uses a large number of die castings. In these various uses, all die castable metals are used and are purchased from a wide variety of vendors. In order that both purchasing and acceptance of castings be uniform within the entire company, specifications have been drawn up that cover the most important conditions of both purchase and acceptance.

The use of very explicit specifications works to the benefit of both vendor and consumer. Where part drawings are sent out for competitive bids, there is a greater assurance that all prospective vendors will be quoting under the same conditions; this is particularly true of the specifications that detail inspection for acceptance.

There have been, and unfortunately there still are, many cases where a vendor has bid on a part, been awarded the contract and then discovered that some of the details of inspection were not given or not made clear at first. The result is often a high percentage of rejected castings and, at best, requires renegotiation of the contract.

Typical examples of some of the die castings used by the South Wind Division are shown above. This particular group includes castings of zinc, aluminum and brass. They further represent parts that are used as-cast, fully machined by the vendor and those machined by the Stewart-Warner Corp. For all of these castings, a detailed set of specifications exists for each as to metal, strength requirement and application.

As a typical example, take the die cast cover at "a" above, an aluminum die casting. The drawing calls for an anodized finish per Mil-A-8625, Type II. In addition, the drawing calls for the part to meet certain company specifications detailed in this manner:

S. W. Spec. 638-01
ABBBB

The meaning of this last specification designation becomes clear when one examines Stewart-Warner Corp.'s specifications for Aluminum Alloy Die Castings. As can be seen, they are for a 12 percent silicon alloy.

Details of composition, physical properties, etc., as indicated on the facing page, are substantially standard throughout industry.

Continued on next page

Here's What Users Have to Say About

MARVEL Synclinal FILTERS

SUMP TYPE (cutaway)

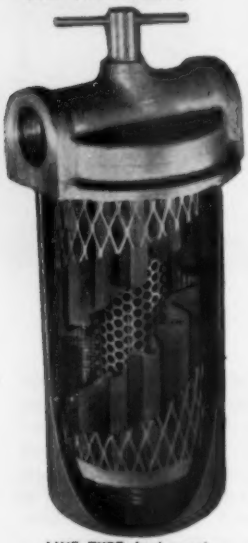
U. S. STEEL CO., Irvin Works Three-Stand Cold Reduction Mill —

"Marvel Synclinal Filters are a part of the mill's main hydraulic system which operates Coil Cradle as well as other hydraulic machines."

JONES & LAUGHLIN STEEL CORP., Aliquippa Works —

"Marvel Synclinal Filters proved their effectiveness when one of the motors on the hydrostatic pipe testers broke down. A brass fitting was chewed up and jagged pieces of brass were carried into the oil stream. Any small piece could clog the circuit resulting in costly "down-time." These pieces of brass could also have caused a great deal of damage to the expensive equipment. However, when the unit was inspected, it was found that all metal particles had been filtered out by the Marvel Synclinal Filters and no damage had been done to the equipment nor was there any loss in operating time. Two filters are installed on each circuit so that one can serve as a by-pass while the other is being cleaned. Although it takes only about fifteen minutes to clean the monel filter insert, even this short interruption in production could be costly in an operation of this size."

MANY OTHERS REPORTING SIMILAR RESULTS ARE NOW SPECIFYING MARVEL SYNCLINAL FILTERS ON ALL NEW HYDRAULIC EQUIPMENT — AND STANDARDIZING WITH MARVEL SYNCLINAL FILTERS ON ALL EXISTING EQUIPMENT



LINE TYPE (cutaway)

For Dependable Protection on All Hydraulic and Other Low Pressure Circulating Systems — Investigate MARVEL SYNCLINAL FILTERS

They Meet J. I. C. Standards

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS

Marvel's most recent developments is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

WATER FILTERS

Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

IMMEDIATE DELIVERY!

As in the past, Marvel continues to offer Immediate Delivery!

Catalogs containing complete data available on request

MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill.
PHONE: JUniper 8-6023

PMM-10

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated:—

- ☐ Catalog No. 106—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog No. 300—For WATER
- ☐ Data on filters for Fire-resistant hydraulic fluids.

Name .....
Title .....
Company .....
Address .....
City .....
State .....

DETAILED SPECS—cont.

The specifications under which the part will be inspected is where these purchase specifications differ from those most generally used.

Each of the letters in the second line of the specification corresponds to the particular sub-head listed and they are given in the order in which each item appears on the spec. sheet. Thus this entire specification will be interpreted in this manner.

S. W. Spec. 638-01—A 12 percent silicon, aluminum base die casting alloy whose composition and physical properties are those given on page 58.

ABBBB—these letters refer to the inspection of condition, finish, parting line, porosity, and pressure testing.

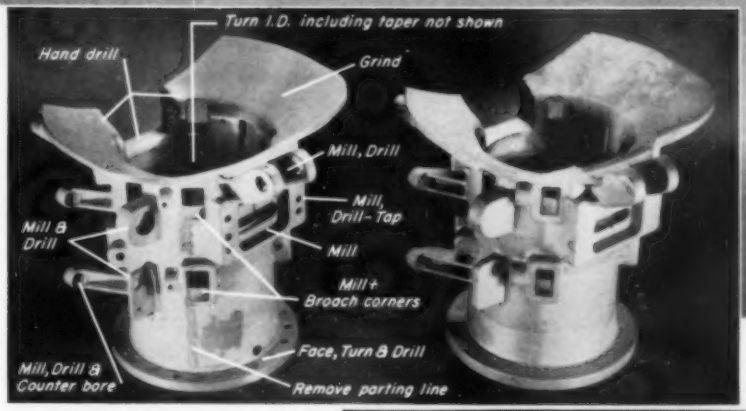
With these detailed specifications, there is no reason for either the vendor or the purchaser to claim, after production has started, that the various points of inspection were not fully covered.

It should be noted further that the purchaser, under these specifications, takes the responsibility for any failure due to improper methods of casting since the specifications require that "Vendor shall submit his drawing, showing how part will be cast to S-W Engineering Department for approval before start of production."

The upper flange shown at "b" in the group of castings is another example of the application of these specifications. In this case, the part is die cast in zinc and a different set of specs applies. Here the specification notation is:

S-W Spec. 670-01
Condition .....A
Finish .....Commercial
Parting Line .....A
Porosity .....B
Pressure Testing ..10 psi

Again, inspection points are clearly defined. The metal specification (S-W Spec. 670-01) covers a zinc base die casting alloy and details both composition and minimum physical properties. The inspection specifications, however, are the same as those given in Spec 638-01 and where an allowable deviation exists, as in the case of pressure testing, this deviation is given on the blueprint.



NO IMPREGNATION is used on these aluminum permanent mold castings which have critical requirements on density and soundness to meet Air Force specifications.

MACHINED AS CAST

By E. W. BOSSI
Viking Tool & Machine Corp.

Sound Castings For In-Flight Refueling

THE foundation of the Air Force as a separate service rests on its inherent superiority in the two principles of range and mobility. Therefore, it is not surprising that in-flight refueling occupies such a peculiarly conspicuous position in the weapons systems picture.

The first in-flight refueling of an airplane was done on June 25, 1923. Flying at a speed of 90 miles per hour a plane was refueled in about two minutes by allowing the fuel to run down a steel wire encased in a rubber hose.

Today, 32 years later, the USAF has made over 120,000 refueling contacts. It is currently averaging over 7,500 contacts and transferring 1,200,000 gallons of fuel per month. Much of this in-flight refueling today is done at jet speeds. Two permanent mold castings on each receiver plane are helping to make this record.

Continued on next page

At the risk of over-simplification, it can be said that the major problem that had to be overcome in refueling was to transfer fuel at high speed in such a manner that accidental disconnects would not result in loss of fuel or damage to either the aircraft or their personnel.

Thus far, two refueling systems have been developed that have proven successful. These are the probe and drogue systems and the flying boom system. The latter system has, up to now, been the most widely used in the United States.

The flying boom refueling system consists, briefly, of a telescopic boom mounted in the tanker aircraft in such a way that the contact is made under the control of a boom operator who manipulates the boom through the use of the rudder-vators and guides the telescopic boom section into the receptacle on the receiver aircraft. Once contact is made, the boom in its design concept is freely telescoping, and it is not under the control of the boom operator or the receiver pilot in any way until the disconnect is made at the end of the refueling operation.

Obviously, if a fairly large diameter boom is to contact the receiver, there must be some connection on the receiver plane and this connection must contain valving and valve actuating mechanisms to both start the flow of the fuel when proper contact is made and to stop fuel flow at the completion of refueling or if accidental disconnect should occur. It is in this receiver connection that the permanent mold castings made by Monarch Aluminum Mfg. Co. are used.

For this type of service, aluminum castings are used, since they possess physical strength and are light in weight. A very considerable amount of machining must be done on the castings and since the surface tension of aircraft fuel is such that it will leak through even the most minute pores, the basic requirement of these castings is structural soundness both as to gross micro-porosity and macro-porosity (this includes blow holes, inclusions, etc.) Further, impregnation of these castings is not allowed under any conditions.

Inspection Costs Are More Than Casting Costs

Because of the rigid requirements, normal procedures calls for X-ray inspection of 25 percent of the castings as received. If a single casting is rejected in this first inspection, the entire lot is 100 percent X-ray inspected. Interestingly enough, the actual cost of inspection of the rough castings is higher than the cost of the castings. So few rejects are encountered in permanent mold castings that the cost is only about 1/3 that of comparable sand castings.

The refueling receivers currently being built by the Viking Tool & Machine Corp. are used on both the RF84F reconnaissance planes and the F84F fighter planes being built by Republic Aviation Corp. The permanent mold casting process has so much more latitude than sand casting that it is possible to use the same castings for both planes by small machining alterations. If sand castings were used, it would not

Continued on page 112

YESTERDAY
TOMORROW
The Trend is with Badger...
BADGER quality makes your product more competitive!
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For more information circle No. 11 on the Reader Service Card

CLEAN-CUT CASTINGS

Close-up view illustrates easy access to metal well from furnace — tie rods are staggered for better accessibility.

The "all new" H-P-M casts cleaner, faster and more accurately — the simple formula for reduced casting costs.

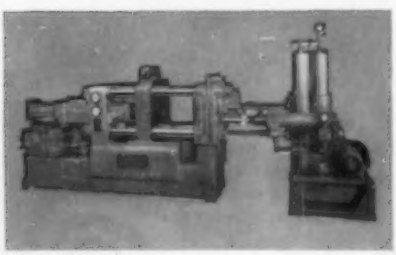
and "Right On The Button" For Size

Cleaner castings, negligible scrap and better dimensional control with production output to meet job requirements are the records being set at Ajax Die Casting & Manufacturing Co., Tulsa, Oklahoma. They're using the new H-P-M Die Casting Machine — the answer to many of today's die casting problems.

H-P-M's all-new clamp design cuts costs on casting jobs. Accurate closing of mold eliminates excessive flash—saves metal and expensive cleaning work, avoids customer complaints. The new clamp design has plenty of "beef" — limits elongation of frame, compression and deflection of locking members; clamps mold firmly during metal injection.

Mr. M. M. Alexander, co-owner says, "We find the new H-P-M Die Casting Machine to be thoroughly dependable and parts are being consistently produced within tolerances. Casting gates are clean-cut with a minimum of flash."

Write today for Bulletin 5400 and see how an H-P-M can *logically* reduce casting costs for you, too.



THE HYDRAULIC PRESS MANUFACTURING COMPANY

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HPM

For more information circle No. 32 on the Reader Service Card

BOOK REVIEWS

REFERENCE TABLES FOR THERMOCOUPLES, National Bureau of Standards Circular 561, issued April 27, 1955, 84 pages, 22 tables, 50 cents. (Order from the Government Printing Office, Washington 25, D.C.)

Superseding Circular 508, this volume gives expanded reference tables for platinum-platinum-10-percent rhodium, platinum-platinum-13-percent-rhodium, chromel-alumel, iron-constantan (modified 1913), copper-constantan, and chromel-constantan thermocouples with temperature in degrees Celsius (centigrade) and Fahrenheit and electromotive force in millivolts as the arguments. The tables are based upon the absolute electrical units and the International Temperature Scale of 1948.

Temperature-electromotive-force tables for thermocouples are used in science and industry to convert measured electromotive force of thermocouples into equivalent temperatures, testing and calibration of commercial thermocouples, the preparation of purchase specifications for thermocouple wire, and in precise calibration of instrument scales in order that temperatures may be read directly.

DIFFUSION OF IRON, NICKEL AND COBALT INTO HOT-PRESSED TITANIUM CARBIDE. New York State College of Ceramics, for Wright Air Development Center, January 1953. 32 pages with tables, graphs and photomicrographs. (Order PB 111612 from OTS, U.S. Department of Commerce, Washington 25, D. C., price $1.00.)

Diffusion of iron, nickel and cobalt into hot-pressed titanium carbide is studied using the radioactive isotopes of these transition metals. Calculation of the diffusion coefficients is made both by the surface decrease method and by the determination of the concentration gradient within the sample. Measurements of the diffusion coefficients were made at 900°, 1000° and 1100°C but evidence is presented that diffusion is dependent upon the structure of the sample. Grain boundary diffusion appears to be the predominant type occurring.

DIE DESIGN HANDBOOK. Edited by Frank W. Wilson, McGraw-Hill Book Co., Inc. 330 W. 42nd. St., New York, N. Y. price $14.50

This volume, published under the auspices of the American Society of Tool Engineers, is planned to cut the die designer's work by more than half on many jobs. The book makes available hundreds of actual designs for cold pressworking, representing the successful practice of many members of the society.

Using this book, the designer may find some one service-proved design that can save 90 percent of his developmental time and effort, with the other 10 percent related to more conventional design matters already well known to him.

Die design is efficiently tied in with all other factors and functions involved in pressroom processes. Thus the book includes material on product design factors, principles of process planning, theory of metal movement and die setting principles and the selection of presses.

IN THE WEST IT'S . . .

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When you buy your die castings from Universal, you are gaining the services of experienced die casting engineers, die designers, production men and management. You are putting a well-equipped shop to work on your castings. You will find, as hundreds of other companies have, that you can depend upon Universal for quality, service, delivery and prices that will help keep your own production costs down.

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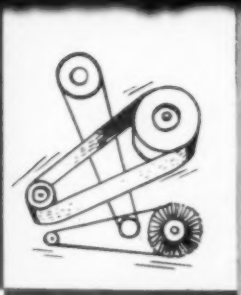
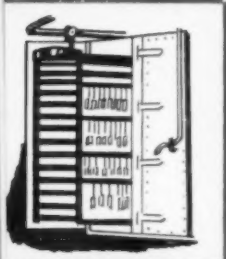
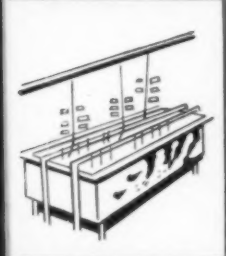
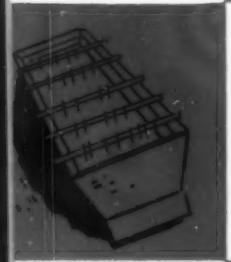
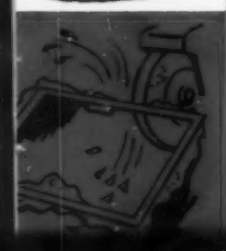









PMM

Finishing Section

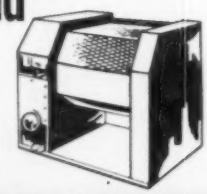
Finishing includes all secondary operations performed on precision metal molded parts — up to and including final surface treatment. This section presents new information about the specialized methods, equipment and materials needed for finish-machining, assembly, surface preparation and final finishing of all precision metal molded parts.

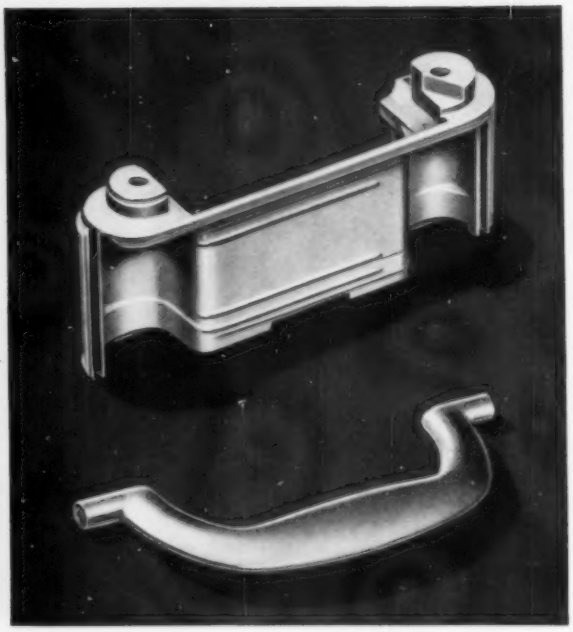
devoted to the specialized problems of finishing . . .

DIE CASTINGS • INVESTMENT CASTINGS • PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS • POWDER METAL PARTS • SHELL MOLD CASTINGS

PRODUCT OF **3M** RESEARCH

New HONITE "Micro Cut" Compound gives super smooth finishes on zinc and aluminum die castings!





Use HONITE "Micro Cut" Compound for Mirror Finish on Stainless Steel

On stainless, new "Micro Cut" Compound mirror finishes without darkening, preserving the metal's bright natural color. Impingement control prevents scratches and nicks—corner break is generated with NO dimension change.

Yes, now you can put a super smooth finish on zinc or aluminum die castings. New HONITE Brand "Micro Cut" Compound contains a brand-new, superfine, natural abrasive (exclusive with HONITE) which assures a smooth finish on every die casting. And HONITE "Micro Cut" Compound can cut the "extra steps" from your barrel finishing operation, too. You can eliminate extra rinsing . . . extra coloring . . . extra labor!

HERE'S HOW! On zinc or aluminum die castings, HONITE "Micro Cut" Compound gently and quickly polishes out surface imperfections without "skinning" or exposing porosity—*and* reduces impingement or nicking, because it holds the parts firmly in the chip mass during the run. You get a quality surface for quality plating on zinc die castings . . . a super smooth surface on aluminum die castings . . . with no need for extra rinsing or coloring!

Write today for a demonstration in your plant of HONITE "Micro Cut" Compound.

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☐ Yes, I'd like a demonstration of HONITE "Micro Cut" Compound.

☐ Send me free copy of booklet: "Facts and Figures Report on HONITE Barrel Finishing", which contains complete information about HONITE barrel finishing compounds.

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For more information circle No. 84 on the Reader Service Card

Here is a practical method to cut down on rejects by salvaging die castings that have defective plating.

BEFORE AND AFTER view of a copper-nickel-chromium plated zinc die cast watch case show how the metal coatings can be stripped off without harmful attack on the basis metal.

How To Strip Plated Die Castings

By W. K. MURRAY,
Enthone, Inc.

IN any manufacturing operation the production of goods of satisfactory quality is usually accompanied by the production of a small percentage of inferior items, commonly called rejects. Plating operations are not exceptions to this rule and methods must be available to salvage those zinc die castings which are coated with defective electrodeposits and which are too valuable to be discarded.

In addition to rejects, items, particularly automobile hardware, on which the plate has worn through in spots or has become damaged, must be stripped, refinished and replated in order to be restored to their original appearance.

The majority of plated die castings are coated with nickel and chromium or with copper, nickel and chromium. The nickel and chromium are effectively removed by making the part the anode in the 50 per cent by volume solution of sulfuric acid at room temperature. Direct current is utilized at a maximum potential of 2.0 volts. The cathodes are made of lead and a lead-lined or plastic-lined steel tank is required.

The work should be dry going into this bath and the solution should be kept covered at all times when not in use to prevent the acid from becoming diluted either by drag-in of water or by moisture absorbed from the air. If the density of the bath falls below 50° Baume', pitting of the zinc will occur.

When the solution is operating properly, the current will remain constant until some of the underlying copper plate or zinc is exposed, after which it will fall gradually to a very low value indicating complete removal of the nickel and chromium.

It is important never to remove the work from the tank, rinse it and then replace it for further stripping since the protective film which forms on the basis metal will have been destroyed during rinsing and attack will occur. The increased current that flows when the part is reimmersed is an indication of this. Violent agitation of the work or the solution will also disturb this film as will operating at a voltage sufficiently high to cause evolution of oxygen gas at the surface of the parts.

Above 50 percent by volume, the concentration of sulfuric acid is not critical. However, the stripping rate becomes slower as the concentration is increased; this effect can be counteracted by increasing the applied voltage. The temperature may tend to rise with continued operation of the bath, particularly at high current densities, and this should be prevented by the use of cooling coils or pitting of the work will result.

In general, increasing the temperature and current density and lowering the concentration will increase the attack on the basis metal and raise the stripping rate; decreasing the temperature and current density and raising the concentration will minimize basis metal attack and lower the stripping rate.

The above solution does not strip copper plate, unfortunately,

Continued on next page

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and if an underlying copper plate is present further steps must be taken. Since copper is a relatively noble metal while zinc is extremely reactive, it is quite difficult to dissolve copper without attacking the zinc.

The most widely used method involves the alternate use of a sulfide solution and a cyanide solution. The first solution oxidizes the copper to loosely adherent, black copper sulfide which is then removed in the second solution. Only about 0.0001 of copper is converted to the sulfide during one immersion and, consequently, the process must be repeated several times to obtain complete stripping.

Any sulfide-containing solution such as liquid sulfur, sodium polysulfide or liver of sulfur can be used for the first bath. A recommended composition is 1 to 2 lb./gal. of sodium poly or tetrasulfide used at room temperature. The cyanide solution can be made up at 6 to 8 oz./gal. of sodium cyanide.

Another method for removing copper from zinc is to immerse the part in a conventional chromium plating bath and to apply 50 to 60 cycle alternating current at 6 to 12 volts.[1] Since the current is alternating there are, strictly speaking, no anodes or cathodes as in direct current operations and the parts may be suspended from both electrode terminals. The chromic acid concentration can range from 27 to 65 oz./gal. and the ratio of chromic acid to sulfuric acid should be maintained at 100:1.

The most critical factors in the operation of this bath are the temperature and current density. Below 68 F. the copper strips very slowly while above 77 F. a dark adherent smut is formed uniformly over the zinc surface. Above 86 F. there is danger of producing heavy etching, either locally or over the entire surface.

The current density should be maintained between 65 and 130 amps/sq. ft. for good results. Below the minimum current density the zinc does not become passive and some attack is experienced. Above the maximum current density the copper becomes passive and stripping ceases.

The zinc surface after stripping by this method is coated with a

Continued on page 82

MEET "LITTLE STEVE," A NEW, SPACE SAVING, LOW COST AUTOMATIC PLATING AND IMMERSION PROCESSING MACHINE

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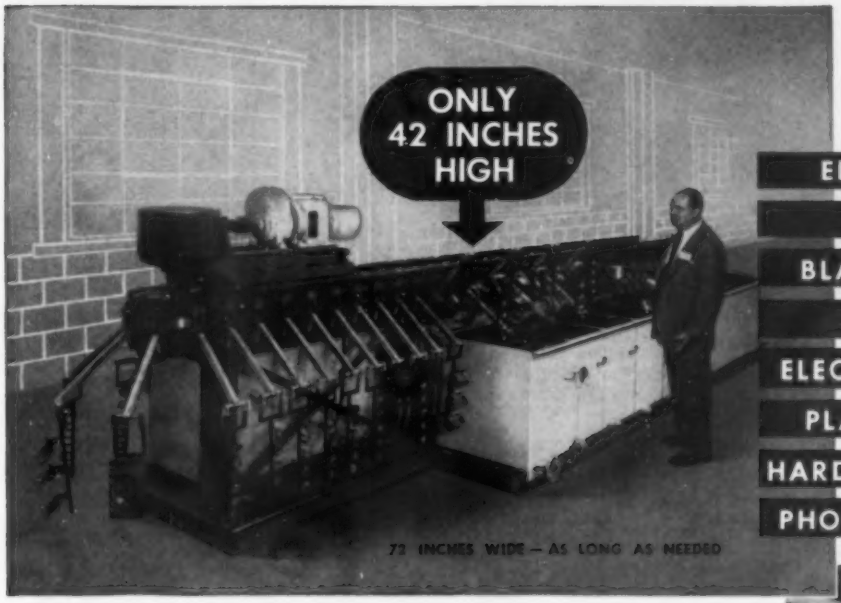

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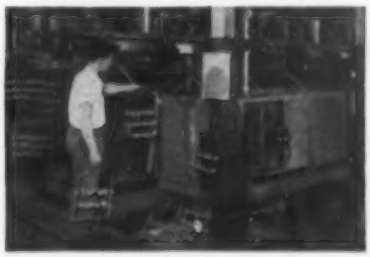
Yes, this new immersion processing machine by Stevens can process up to 40,000 pieces per day – and it has a variety of other uses too.

Ruggedly built "LITTLE STEVE," the hit of the 4th Industrial Finishing Exposition, can be obtained at a surprisingly low initial cost. It is ideal for large or small companies for it will fit many production cycles. It uses an arm as a rack or will take racks for small parts.

Being of small size it offers no floor space or load problems; involves low solution expense and means a small capital investment. It can be used easily as a laboratory testing machine.

For further information about "LITTLE STEVE" write for illustrated folder or call your local Stevens sales engineer.

A single part can be placed on each carrier arm as shown in the illustration above or racks of numerous parts can be used.



If a larger production model is desired the "Sgt. Steve" unit, using the same basic design, will provide the answer.

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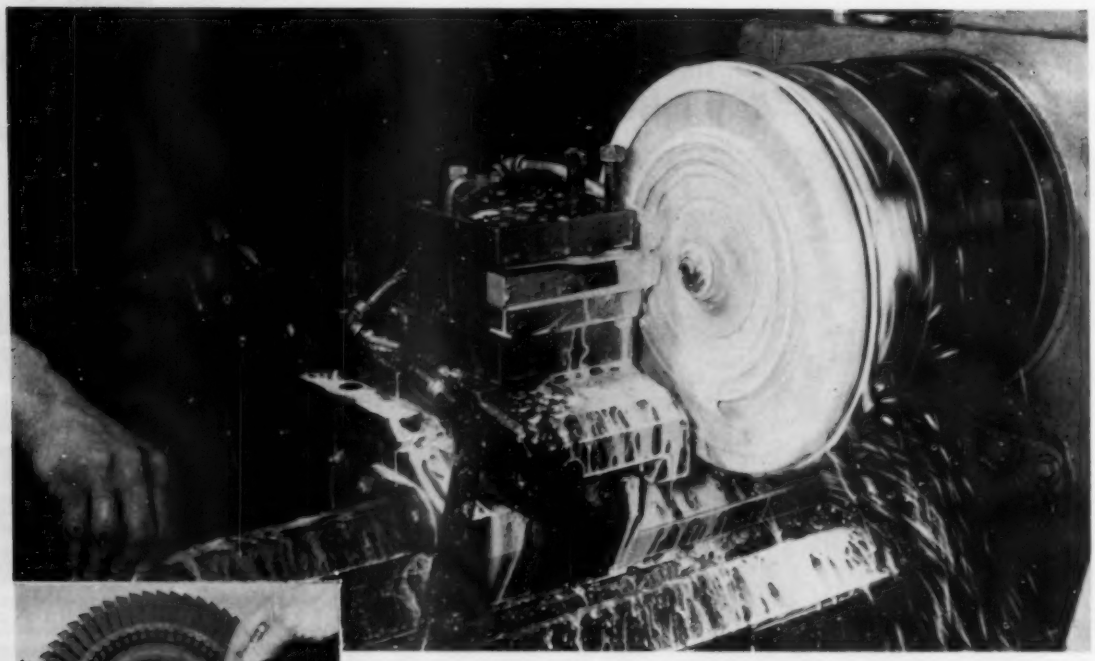

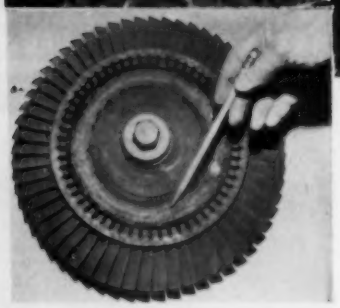

INSTEAD OF USING 60 tools to get a daily production of 25 of these turbine wheels made of two hard-to-machine alloys, this setup calls for only 20 tools to get a daily production of 48 units. Proper grade of carbide tool is credited.

This company has doubled output in

Machining Stellite And Inconel Aircraft Wheels

USE of the proper grade of carbide in machining aircraft turbine wheel buckets provided some unexpected dividends recently at Kelsey-Hayes Wheel Co., Jackson, Mich. It compressed a two-cut operation into one, reduced the number of tools required by two-thirds and almost doubled production.

Like other companies machining Inconel and Stellite metals, Kelsey-Hayes had its share of problems. The part being faced was the type of wheel bucket used in a turbo-compound gasoline engine. It basically operates on a turbo-superchanger principle in which the energy of escaping exhaust gases is mechanically harnessed, and transmitted to provide additional power to drive the propeller shaft.

The turbine wheel bucket assembly itself is 12 inches in diameter, 8½-inches of which is the actual wheel of Inconel, heat treated to 18 Rockwell C. Balance of the wheel is a rim of Stellite buckets welded to the main portion of the wheel.

Machining was complicated not only by the toughness of the Inconel metal, but also by the weld which is rough and extremely irregular to impose the stresses of an interrupted cut during the facing operation. Furthermore, the facing cut at the outer edge of the wheel runs about ¼-inch into the Stellite bucket rim, placing the tool in position to cut two different types of metal at the same time, and under the same conditions.

With previous cutting tools the work, done on a 7½-horsepower, Warner & Swasey engine lathe, consisted of making two separate cuts to complete one bucket. This required the use of 60 tools to get a daily production of 25 units.

With the application of Carboloy grade 370 carbide tools, the facing operation on each bucket is now done in one cut. In a day's run only 20 tools are required and daily output is up to 48 units.

The job is run at only 56 rpm, the standard 370 carbide tool taking a ⅜-inch depth of cut at a feed of 0.0155-inch per revolution or 0.746-inch sfpm.

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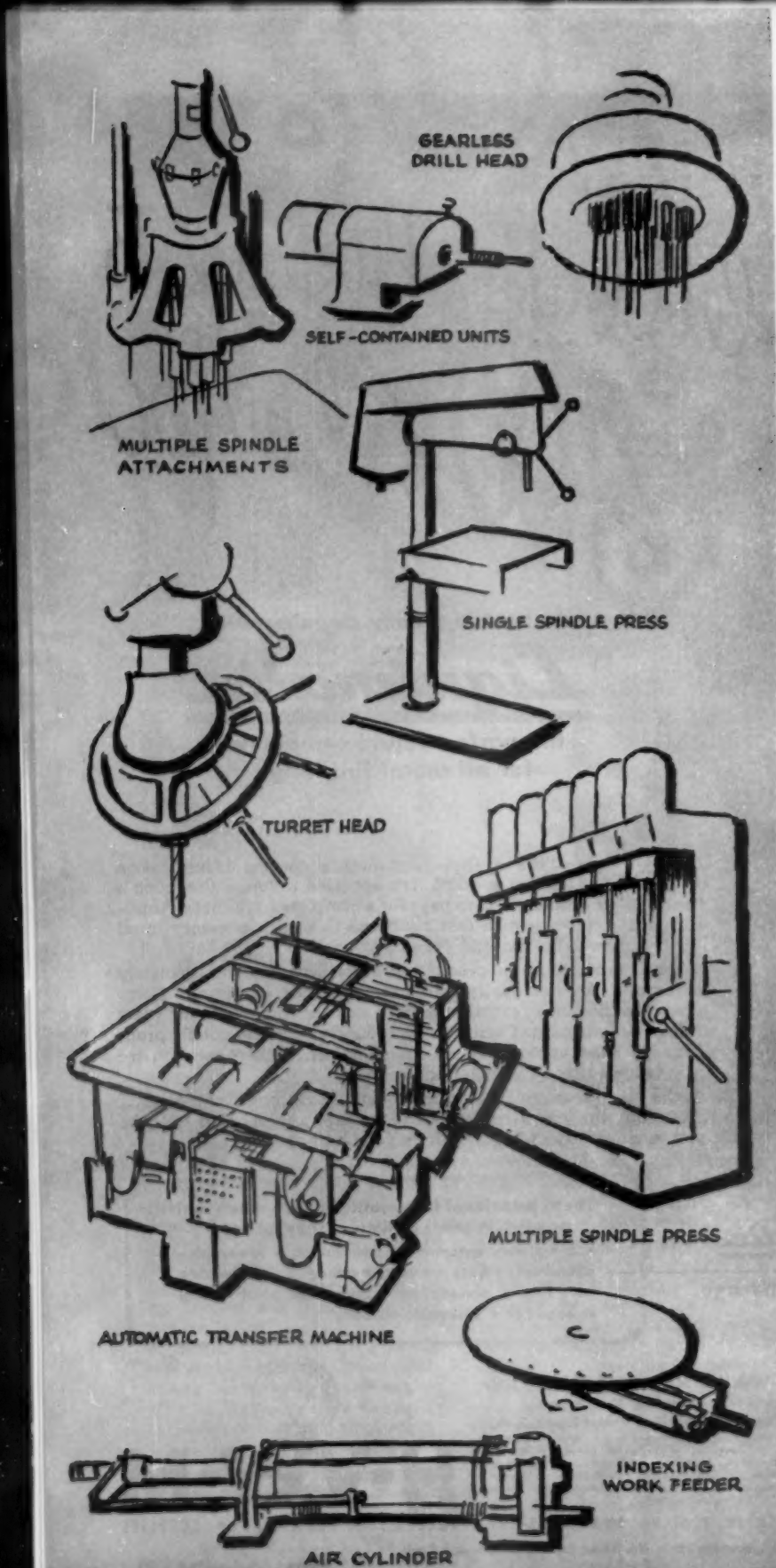


HOLES..

WHY DRILL?

A JOKER once remarked that a hole is "nothing surrounded by something." If so, then most metal working plants spend a lot of money for "nothing," since drilling holes and tapping them are probably the most common secondary operations on any metal parts.

This is especially true of die castings, where the designer's natural inclination to consolidate as many features as possible into a single die casting results in complex shapes with mounting holes in just about every surface. The average die casting has dozens of functional holes.

The product designer, believing that die castings should be "ready to assemble" as they come from the die cavity, is likely to say, "Let's core *all* the holes and save money!" Sometimes it does save money to core holes, often it is cheaper to drill. Best practice to follow is to consult with the die caster who can tell you which holes to core, which to spot, and which to drill completely.

Why drill? If holes are easy to core in a casting, why go to the expense of forming holes any other way? As any die caster can tell you, cores which are pulled in the same motion as that which separates the die halves are inexpensive to make or maintain. But when cores lie at an angle requiring rack and pinion or hydraulic actuation for withdrawal, the cost of tooling and maintenance is higher, athough it is still practical. Very often however, the shape and size of the casting, or the construction of the die indicate that it will be cheaper to drill than to core.

drilling and tapping save you money when you pick the correct method

Some conditions favoring drilled holes include: 1) when the hole diameter is too small in relation to its depth; 2) when center distances between holes must be held to closer tolerances than normal die casting practices; 3) when the hole lies at an angle that would unduly increase the cost of die construction or maintenance; 4) when holes must be accurately aligned on opposite sides of the casting; 5) when coring would slow down the casting cycle drastically; 6) when it would be necessary to remove draft from the hole in any event; or 7) when the same casting is used for more than one model requiring different hole distribution for each.

The fact is that millions of holes are drilled in die castings because this is a fast, inexpensive and accurate operation. Yet the selection of a machine, fixture and method of drilling (and tapping) should be worked out carefully.

Many types of machines and accessories are available for high production drilling and tapping. Sometimes the choice is limited by machines already available in the plant, but generally on long-run jobs such as are characteristic of die casting usage, the purchase of new, appropriate machines can easily be justified. Even a very small saving per piece when multiplied by production quantities in the millions can pay for a machine tool and still save money.

The fact that die castings are closely uniform from piece to piece, that they are usually produced in large enough quantities to amortize tooling costs easily, and that each piece is likely to have many holes in one or more surfaces... suggests high speed production line setups. Here are some of the basic types of equipment used for drilling and tapping die castings:

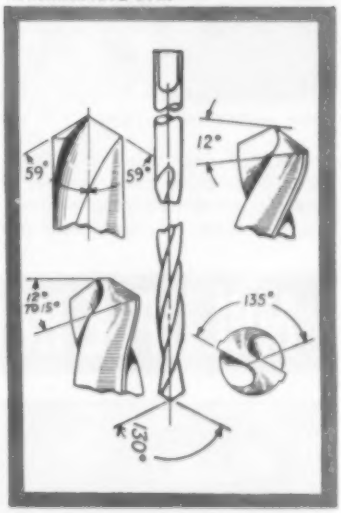
Single Spindle Drill Press: This is the work horse found in almost every shop that processes die castings. Available in many makes and models, either floor or bench mounted, the single spindle press is very adaptable. While elaborate jigs are often used with it, it is also easy to use freehand or with simple boxtype roll-over fixtures. Used in conjunction with air or hydraulic feeds, rotary work tables or other accessories, it becomes an automatic or semi-automatic production line tool for either short or long runs.

Multiple Spindle Drill Press: Grouping operations into one machine so that they can be performed simultaneously or in rapid succession is accomplished with a multiple spindle machine. In this type of machine, many drills or taps are mounted in a single machine. This type of unit produces more holes per hour and maintains high accuracy but is less flexible for short runs, usually requires more expensive tooling, and takes more setup and down time. It is sometimes engineered especially for a single long run job.

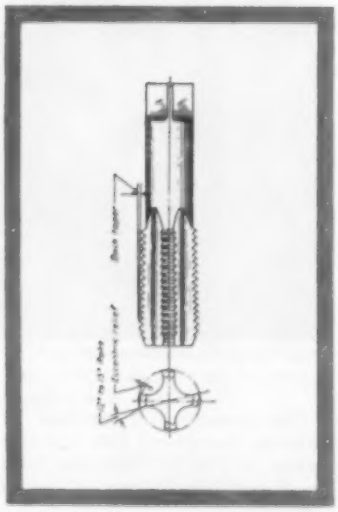
Drilling Machine Attachments: Many types of accessory units are

Continued on page 75

Recommended Drill



Recommended Tap



ONE-AT-A-TIME drilling and tapping

Photo: Ansul Chemical Co.

Drilling one hole at a time, even when there are a number of holes to be drilled, is quite common practice. Where holes are spotted by means of shallow cored depressions, it is a rapid and simple job for the operator to manipulate the casting from hole-to-hole beneath the drill. A simple fixture ensures squareness.

Aside from the conventional floor or bench-mounted single spindle unit, a large variety of special drill units are available that are completely self-contained units. These can often be mounted in such a way that the drilling of a single hole can be synchronized with other machining operations. The mounting of these units to perform successive hole drilling operations around an automatically indexing work table also is a high speed solution to the production of holes in many surfaces.

Where many holes of varying depths, diameters and accuracy are needed, it may be more expeditious to process some of them one at a time, grouping the remainder into a multiple operation. Certainly the machining ease of the die cast alloys allows either type of setup with maximum effectiveness.

MULTIPLE-HOLE drilling and tapping

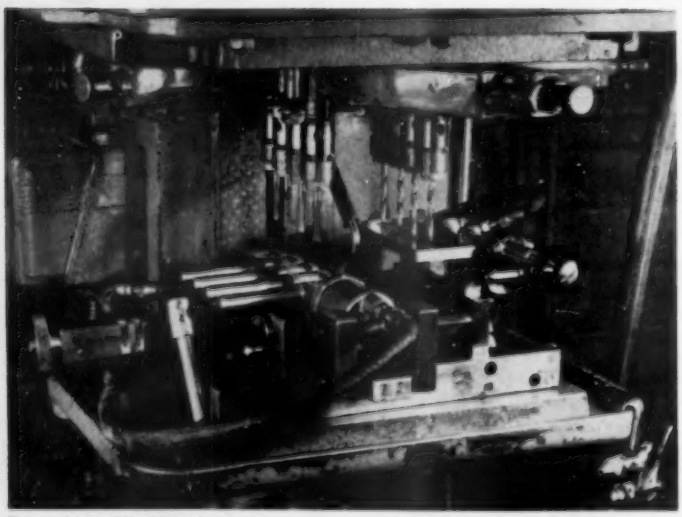


Photo: British Information Services

The grouping of drilling or tapping operations into a single setup employing multiple head machines, attachments or special machines, is part of today's trend toward automation. Obviously, if a half dozen holes can be drilled with acceptable accuracy in only slightly more time than a single hole could be drilled, then it is possible that the increased tooling cost for the larger setup may be quickly amortized.

Multiple spindle operations are not necessarily expensive to tool, since multiple spindle heads are available to convert single spindle to multiple spindle at low cost. On an increasing number of jobs, due to the long production runs involved, special multiple spindle machines are paying for themselves in increased speed, improved finish and accuracy. Even major, transfer type machines where die cast parts proceed automatically from station to station for successive drilling and tapping of large numbers of holes without any manual assistance, are finding justification. Arrangements of several self-contained drill units, coordinated by means of air cylinders, limit switches and indexing work tables, constitute low cost multiple-operations setups.

available for mounting on a single spindle machine to extend its usefulness. Several types of multiple spindle heads are offered, transferring power from the press spindle to several individual spindles. Location, speed and number of these individual spindles can usually be very accurately adjusted. One unit, for example, permits spacing of drills as close as sum of the drill diameters. Lead screw tapping attachments are available.

Self-Contained Units: Compact, well-integrated drill units are available containing the power source, either air or electric motor, as an integral part of a bench-mounted unit. These can be set up in such a way as to become special-purpose drilling machines built of standard units. They are commonly used for radial arrangements of drills, simultaneous or synchronized drilling (or tapping) of small holes in several surfaces, etc. They allow great flexibility in planning the setup.

Feed and Control Units: Because so many production engineers have found that an auxiliary feeding arrangement can increase output, save tiring manual labor, improve uniformity of drilling or tapping, and prevent bottlenecks, units for feeding are almost standard parts of drilling and tapping departments, particularly those involving single spindle or self-contained units. Air and hydraulic feeds for the drill, and for the workpiece, have converted many slow hand operations into automatic or semi-automatic operations keyed to high volume production. This includes rotary work tables which carry the work through a number of stations and operations.

Automatic Transfer Machines: A number of installations have recently been made whereby large die castings are automatically machined, with the palletized castings moving from station to station by means of a conveyor system which turns the castings as required. The high machine cost can be offset by the low labor cost where volume of work and number of operations are sufficient.

Many factors go into the choice of equipment, but probably the two basic considerations are: 1) number of holes that are practical to process simultaneously, and 2) number of pieces to be processed. In addition, of course, the desired accuracy, location of holes, possible variations in rates of feed and speed, depth of holes must be considered, along with possible grouping of other secondary operations such as milling, cross-drilling, boring, etc.

Tools and Practices for Drilling

Die cast alloys are all free machining, although the high silicon aluminum alloys are somewhat more abrasive and require more frequent sharpening of tools, or use of high speed or carbide tooling where accuracy or finish is critical.

Most common practice is to use carbon steel drills where holes are shallow, or the job consists of running a drill in to clean a cored hole. These drills, where usable, are most economical, but for deep holes, longer runs, or more critical finish, high speed steel of the high spiral type is usually recommended. Carbide tips are used only where production runs are especially long or where finish requirements are close. The superior wearing qualities of carbides give longer time between grinds, and where the machine tool has adequate power, allows extremely high cutting speeds.

Grinding of drills, illustrated on page 73, should ordinarily give a 118° included angle of point, although it may be varied from 90° to 136°. Lip clearance should be at least 12° but may range from 15° to 20°. A small flat on the lip (giving zero rake) helps prevent "grab".

Because of the tendency of die cast metals to solder to the cutting edge of tools, resulting in tearing or galling of the surface, it is recommended that flutes be polished to reduce this tendency. If tools are kept well sharpened, this problem can be largely overcome.

Die castings can be machined successfully at speeds from 300 rpm to 3600 rpm, depending upon speeds available in the machine, but a good average speed is reported to be about 1750 rpm. High speeds and slow feeds give best results, with 200-300 ft. per minute as the recommended surface

Continued on page 94

RECOMMENDED PRACTICES

1. High speeds and slow feeds give best results in drilling die cast alloys.

2. Proper grinding of drills and taps will overcome common problem of sticking, tearing and soldering of soft metal.

3. Because of the high accuracy of die castings, you should consider grouping operations for increased output.

4. High speed steel drills of the high spiral type are recommended for the majority of long-run jobs, although carbides are becoming more common, especially where finish requirements are close and quantities large.

5. Check with the die caster before deciding which holes to drill and which to core.

6. Tapping with lead screw will minimize tap breakage, which is a common problem on small diameter holes.

7. Lubricants for drilling and tapping are not necessary, although it is sometimes helpful to use lubricants for high speed drilling or tapping to keep the tools cool and help surface finish.

8. Auxiliary drill press equipment is a good investment to step up production.

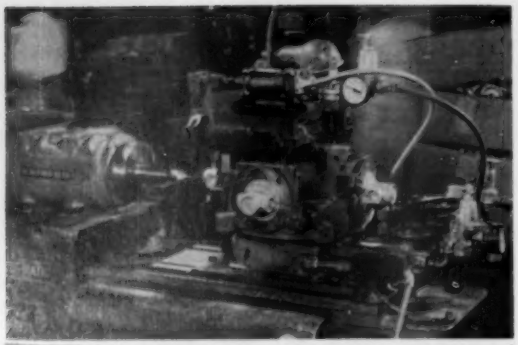
9. Investigate the possibility of drilling or tapping two or more pieces at a time. You may be able to double output with only slightly more tool cost.

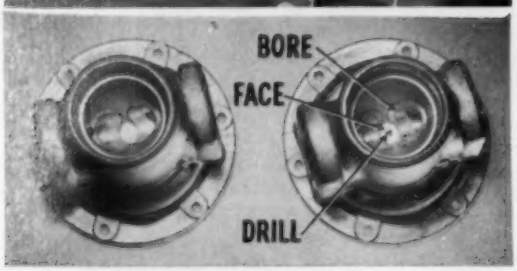
10. To minimize tap breakage, consider using lead screw tapping heads, which also improves blind hole tapping and improves thread quality.

PRODUCTION DRILLING AND TAPPING

Drilling and Tapping in Production

These nine outstanding examples of efficient, high production drilling and tapping of die castings show the variety of equipment and setup in use today.





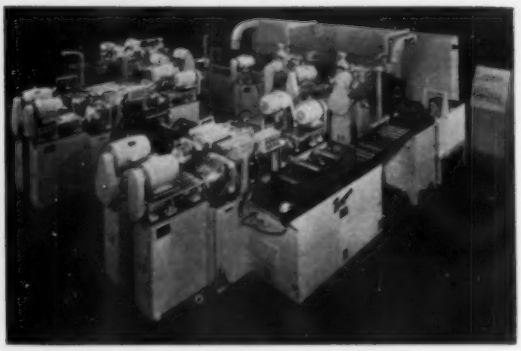
CASE NO. 1 — Combined drilling, facing and boring operation using standard boring head, rotary work table and air motors. (Maxitrol Corp.)

The Setup — Heald Bore-Matic with standard head, and Bellows 4-station rotary work table and air motors to clamp the work in position and insert the shot pin.

How It Works — An unusual, special boring tool in which the drill can be inserted is used. Carboloy tool for facing is accurately ground to 60° included angle. Drilling is held to .125 -0.000; boring is held to 1.141 +0.001 -0.000; facing is done until the part is cleaned up.

Formerly used a single station with hand screw clamping. Now, operator depresses a switch, the table indexes and the shot pin cylinder, locating, trips a switch to actuate the clamping cylinder. When clamping stroke is complete, clamping cylinder trips switch causing boring machine to traverse and make its cut, after which machine table begins to retract, trips Micro Switch, which indexes table. During indexing, shot pin is retracted, actuating a Micro Switch, bringing about the clamping of the cylinder to complete the sequence.

The use of rotary work feed and air clamping has increased production from 1000 to 2500 pieces per day, and operator fatigue has been greatly reduced.



CASE NO. 2 — Drilling, reaming and tapping 56 holes at six different angles in a palletized transfer setup. (International Business Machines, Plant 2)

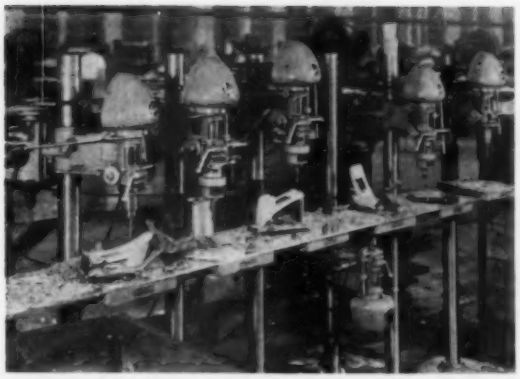
The Setup — A Zagar pallet-type transfer machine with 16 Zagar standard gearless drill heads (224 spindles), 16 Zagar hydraulic feed units, 26 work-holding pallets, 1 pallet wash rack, and 1 complete hydraulic system of moving, turning, clamping and washing pallets.

How It Works — Two die cast aluminum typewriter frames are held in each pallet. One operator is required to load and unload, with maximum potential output of 100 pallets (200 parts) per hour.

To save space, the 100-ft-long unit is set in a 25-ft square. It has 38 electric motors from 1 to 15 hp. Heavy pallets (114 lbs each) are never lifted by operators. Eight double stations perform 16 operations. In a complete circuit, the pallet has carried two parts to 16 sets of spindles, has been turned around twice and flipped over twice and returned to starting position. It dunks the work in washing solution 18 times.

The electrical panel which controls the switches fuses and timers is 20 ft long and 8 ft high. Safety arrangements have been built into the control panel, in addition to which, a "ripcord" runs around the machine at eye level; hit from any spot, this rip cord stops the entire machine. Also, flashing lights indicate status of every operation, and machine is integrated so that no movement will occur until all stations have completed their operations. Machine is set so it will not operate until lubrication pressure throughout the unit reaches a safe level.

With the increase in size of the average die cast component, this type of setup is likely to become more popular among major users of die castings.



CASE NO. 3 — A series of standard single spindle drill presses perform a sequence of operations on a die casting. (Electric Auto-Lite Co.)

The Setup — Six standard Delta 14" drill presses are grouped together, with a steel plate clamped across the tables. Drill press No. 4 is set beneath the table to operate upward.

How It Works — Using very simple fixtures (and no fixtures at three of the stations), the workpiece is moved quickly and easily from position to position. This allows great flexibility in spacing and grouping of drills without special equipment.

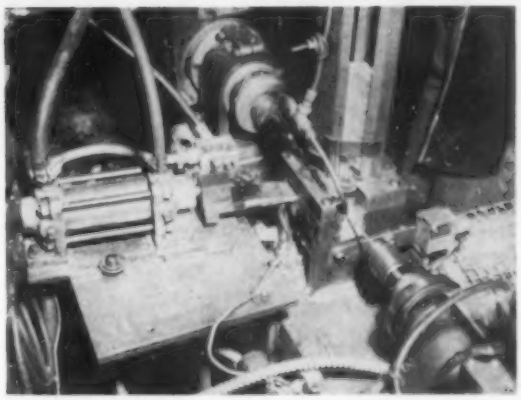
CASE NO. 4 — Turret drill and tap an aluminum elbow.

The Setup — A Howe & Fant turret drill, with a 3-position lever transfer, air clamp, bolted to the machine table.

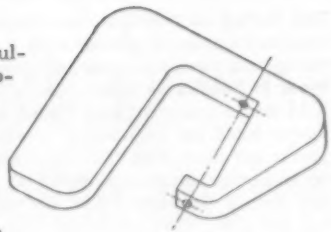
How It Works — Operations performed at a rate of 73.2 pieces (512.4 machining operations) per hr: 1) load; 2) spot 2 holes ⅜x90°; 3) index turret and drill 2 holes .272 diam x .625 deep; 4) index turret and tap 2 holes 5/16-24 class 3 fit; 5) index turret and core drill hole .801 diam x .410 deep; 6) unload and clean.

Use of air clamp and simple fixture provides 3 predetermined work positions for minimum transfer time and proper location. Each tool works at preset speed: spot drill, 1825 rpm; .272 diam drill, 2375 rpm; 5/16-24 tap, 1150 rpm; .801 diam core drill, 825 rpm.

This setup increased production 53 percent over 4-spindle drill press with box jig. Rejects are virtually eliminated, tool life increased.



CASE NO. 5 — Simultaneously drill 2 opposed .160 and .162 diam holes through ⅜" and 5/32" walls using self-contained drill units. (Acme Die Casting Corp.)



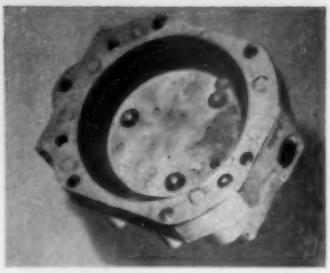
The Setup — Special-purpose machine using two standard Dumore Series 24 drill units, gravity feed and air cylinder ejection.

How It Works — When drilling of two opposed holes on a drill press failed to hold required .002 alignment tolerances or meet hourly production requirements on this die cast zinc automobile door lock, the die caster sought outside bids. Quotes averaging 2¢ per piece were too high, since high production-low cost secondary operation was the key to the company's original price.

Two standard self-contained drill units are now used, with mounting brackets and gravity-feed. Tool costs of $250, plus two drill units, give completely automatic unit to cut costs to less than 1/10¢ per piece, while increasing output to 1500 pieces per hour.

Inexperienced operator can load pieces into hopper, gravity feed forces piece into drill fixture, then air cylinder ejects it into chute where it slides into packing box. Variety of standard mounting brackets available will permit drill units to be transferred to other jobs.

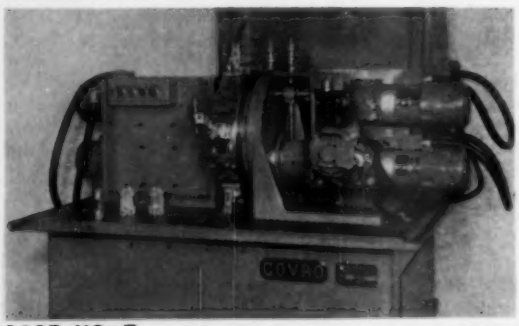
Turn The Page For More Case Studies



CASE NO. 6- Special machine using self-contained air drills is used to drill two holes at an angle simultaneously. (Minneapolis - Honeywell)

The Setup — Two Bellows Hydrair drill units are mounted on angle plates, with a single locking air clamp and manually operated valve to hold the part.

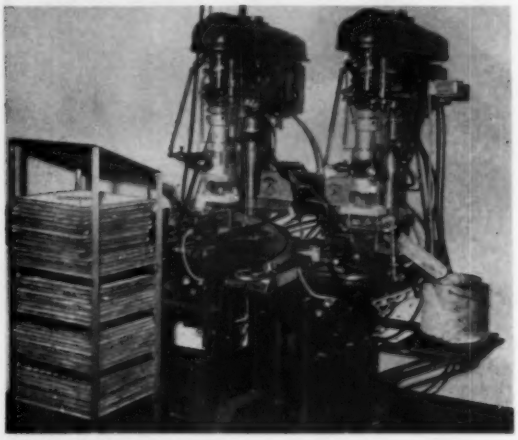
How It Works — Tolerances of ±.005 on depth are held while angle drilling these die cast aluminum power head for regulators. Production rate is 154 pieces per hour with floor-to-floor time of about 2½ seconds. Operation is simple: the machine is loaded and both units started with a single switch, completing the cycle simultaneously. Special wiring permits synchronizing the drills, which turn at about 17,000 rpm and use no lubricant.



CASE NO. 7- Drilling and reaming two opposed holes in an aluminum die casting using a special automatic indexing machine.

The Setup — Four Govro-Nelson Model KH automatic drilling units operate in conjunction with and interlocked with a vertically mounted index dial.

How It Works — Fixtures are designed to suit either a left or right hand part, and simply by loading the parts in proper position, either hand can be drilled and reamed without any adjustment of the machine. Parts are loaded and clamped manually, automatically indexed and ejected into a chute at rear of machine. Output is 900 parts per hour.

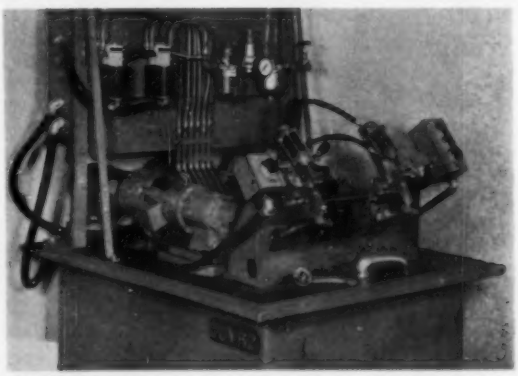


CASE NO. 8- Deburr six holes on each side of a zinc die casting. (Talon, Inc.)

The Setup — Two six-spindle Zagar gearless drill heads are on single spindle Delta drill presses.

How It Works — The left-hand drill unit is hopper fed by means of a chute. After drilling, parts slide down another curved chute, where an operator picks them up and places them in the chute leading to the right-hand drill press. After drilling, they slide down another chute where they are counted into a pail.

Production rates are very high, downtime very low. These machines sometimes operate three or four days with downtime. Output is 18 pieces per minute (8,640 per 8-hr. shift) by one operator.



CASE NO. 9- Tapping two ¼-20 holes simultaneously with automatic self-contained tapping units.

The Setup — Four Govro-Nelson automatic tapping units, two with extension spindles, and a fixture capable of taking right or left hand parts, are used with air-operated clamping and unloading fixtures.

How It Works — Operator loads a right and a left hand part on locating plug and nest arrangement and depresses two start cycle switches. (This is safety feature to prevent cycle starting while operator's hand is in the way.) Parts are automatically clamped, tapped, unclamped, and the locating plugs withdraw into the fixture momentarily, dropping the parts off, and then returning to their normal position ready for the next cycle. Production rate is 600 parts per hour.

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Brand new! . . . Norton TUMBLEX "T" — bonded, triangular shape tumbling abrasive

Users report Tumblex "T" abrasive brings many new "TOUCH of GOLD" benefits to barrel-finishing

Here's one of the most revolutionary barrel-finishing innovations ever developed. In typical on-the-job tests, Norton customers report that the new Tumblex "T" tumbling abrasive:

"cuts tumbling cycle time from five hours to one hour."

"finishes steel and magnesium parts that could never before be barrel-finished."

"completely removes burrs from stainless steel parts in four hours. Abrasives previously used failed to do so in 12 hours."

Everything about Tumblex "T" abrasive is designed for better barrel-finishing.

Its uniform triangular shape and size prevents wedging in recesses of parts.

Made of famous Norton ALUNDUM abrasive, it cuts fast, with no compound needed — resulting in shorter time cycles and lower costs per piece finished.

It provides maximum surface contact with parts being processed, assuring top quality work in fastest time.

It wears down evenly, keeping the same triangular shape. No small chips to lodge in holes, slots, etc. — and when worn down it can be used on parts requiring a smaller size abrasive.

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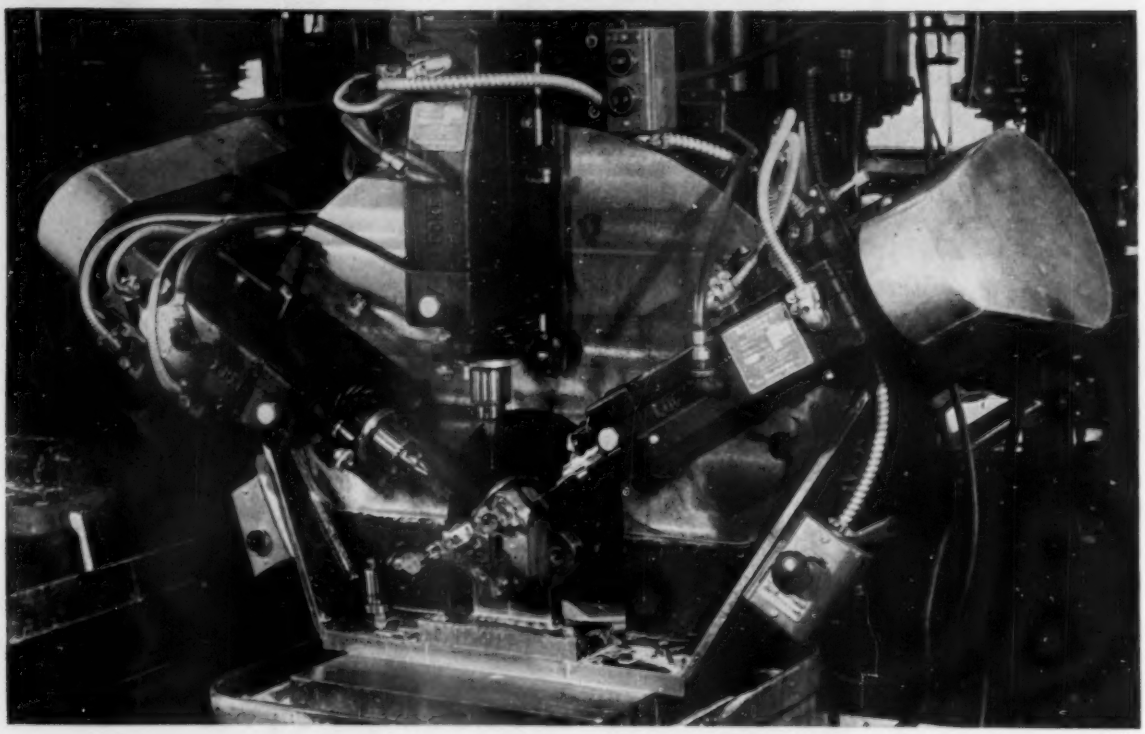
The Case of The Bellows Co.
VERSUS
The High Cost of Drilling Holes

Testimony taken by tape recording in the plant of [redacted], Detroit, Michigan

Operation: Drilling three ¼" holes with a tool-room-built machine, incorporating three Bellows-Locke Drill Units



1102A

Statement of [redacted], General Superintendent

Q. How was this operation performed before you built this special machine?

A. We drilled on a single spindle by hand, with an index fixture to locate the three stations. However, it was difficult to hold a true position and the hole did not come through parallel from one end to another.

Q. Why wouldn't it come through parallel?

A. On account of feed and speed. The feed had to be controlled by hand.

Q. The old way, besides hand feeding, you would have to hand index the part?

A. Right. We had to index every time we drilled a hole.

Q. Can you give me a comparison of production rates on the old method and on this machine?

A. We increased almost 50%.

Q. What is the highest rate of production you get on this machine?

A. Somewhere around 240 pieces per hour.

Q. What other advantages have you found? You get a good deal less spoilage on finished parts, don't you?

A. Yes, considerably. We hardly get any spoilage at all now.

Q. On the old method, did you need to use a skilled operator?

A. Well, he had to know something about it in order to handle the drill carefully. When we're using a No. 60 drill, it does require a person that knows how to handle it.

Q. On this machine, you just use a girl operator, don't you?

A. That's all—the machine takes anybody as long as they can put a part in and press the button and take the part out.

Q. How long has this machine been in operation in your shop?

A. I can't tell exactly—about six months or more.

Q. Has it been working every day?

A. 9 hours a day, 5 days, sometimes 6 days, a week.

Q. Do you have other Bellows equipment in your plant here?

A. We have two infeeds on centerless grinders; we have all our milling machines operated by Bellows Air Motors; vises operated by Air motors; also on Dearborn fixtures which we index; as well as Air Motors on collets—it's all Bellows operated.

Q. Do you find this equipment adaptable for use on other machine tools?

A. Yes, we find it can be used on any machine.

Q. How long have you been using Bellows equipment here?

A. Ever since I remember—around 1945 or '46, during the last war.

Q. Do you have any of those old Bellows Air Motors around here now?

A. Yes, we have quite a few—a number of them were destroyed in 1948 when we had a fire, but after the fire we were able to overhaul them and put them back on the machines.

Q. You mean you put them in operation after they were damaged in the fire?

A. That's right.

Q. Are they still working?

A. Some of them are still working.

Q. They must be about 10 years old now?

A. Yes, they must be.

Statement of [redacted], Machine Operator

Q. [redacted], how long have you worked here?

A. Eight months.

Q. Did you do this operation on the old machine you had to do it by hand?

A. Yes, sir.

Q. Could you tell me a little bit about that?

A. Well, it was not as easy to work as this new machine.

Q. Why was it hard to work on the old machine?

A. Well, you had to turn it every time you drilled and on the automatic, it turns by itself.

Q. And each time you turned it, did you have to pull the drill down?

A. Yes, we had to pull the drill down each time we drilled a hole.

Q. Did your shoulders get tired?

A. Oh, yes. It made your arms and shoulders awfully tired.

Q. Did you have to take any rest periods on the old machine?

A. Yes, because my arms would get so tired I couldn't keep on working.

Q. How often would you have to rest?

A. About twice during the morning.

Q. When you'd go out to lunch after working on this old machine—did your arms get stiff or anything like that?

A. Yes, at night—especially when I'd quit work, they'd get awful stiff.

Q. What did you do for it?

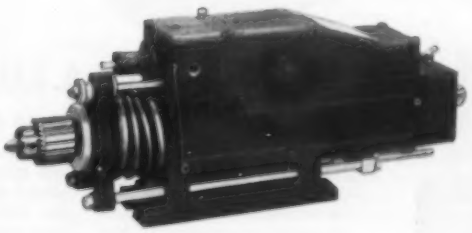
A. Rub them and bathe them and that's about all, I guess. Then do it again the next day.

Q. I imagine you like this new operation pretty well?

A. Oh, yes, I like this fine.

The electrically driven spindle is fed by air power up to the work at which point hydraulic feed control takes over. Built-in speed controls permit regulation of rapid traverse. Drill depth adjustable up to 3". Drilling capacity up to 3/8" in mild steel. All controls are built-in. Valving is electrically actuated. Depth accuracy .005" (with optional electric depth control .001"). Optional deep hole drilling controls. Available in three types: pulley driven, in-line direct motor drive, or parallel mount motor drive. Also available with reversing motor for direct tapping operations.

This Is the Drill Unit That Increased Hole Drilling Production Almost 50%



WRITE FOR THIS BOOKLET

Describes the Bellows-Locke Drill Unit in detail—shows how and where it can be used to best advantage. Free on request. Address: The Bellows Co., Dept. PMM 1055 Akron 9, Ohio.

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The Bellows Co.
AKRON, OHIO

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PMM 1055

For more information circle No. 71 on the Reader Service Card

HOW TO STRIP PLATE

continued from page 68

passive film which must be removed prior to replating. This can be accomplished by buffing or by dipping in 1 vol. % muriatic acid until uniform gas evolution is obtained.

Recently a proprietary stripping solution* has been introduced which has considerably simplified the stripping of copper, nickel and chromium from zinc die castings in that all three coatings are removed in the same bath.

The work is made the anode in a solution of mixed mineral acids[2] at temperatures ranging from room to 180 F. depending upon the rate of stripping desired. The application of 6 volts direct current will result in relatively high current densities and rapid stripping during removal of chromium and nickel and lower current densities and stripping rates during dissolution of the copper.

When the zinc is reached a passive film forms which prevents attack on the die casting and causes the current to drop to almost zero. There is no etching or pitting during the stripping operation. During rinsing a slight cloudiness forms which is easily removed by light buffing.

The bath is controlled entirely with a hydrometer and should be maintained at 53° Baume' by the addition of either water or solution as required. Only dry work should be immersed.

A lead or lead-lined tank can be used as the cathode and the stripped metals will gradually plate out on the tank walls in a loosely adherent form. As these deposits build-up they become detached and form a sludge on the bottom of the tank which can be periodically scooped out.

Since the solution serves primarily as an electrolyte for the transfer of metal from the anode to the cathode and is not consumed in the stripping operation, additions are required only to replace dragout losses.

The various methods discussed above represent the most successful and widely used means of stripping copper, nickel and chromium from zinc die castings. With the exception of the sulfide method for removing copper, they all require the use of electric current. While this necessitates racking of the parts for stripping, the low cost of maintenance of the solutions usually makes the cost of the overall operation justifiable if the die castings thus reclaimed have any value at all.

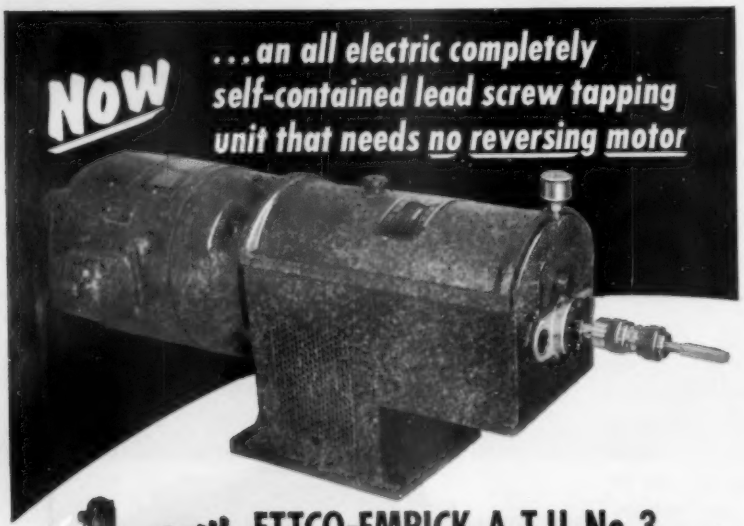
In general, a coating or combination of coatings of total thickness of 0.001 can be stripped for less than ½¢ per sq. ft. of die cast metal if all of the coatings are removed in one operation.

*Enstrip L-88, Enthone, Inc., New Haven, Conn.

References

[1]W. B. Stoddard, Jr., Trans. Electrochem. Soc., 77, 207 (1940).

[2]R. W. Goral and R. Goral, U. S. Patent 2,706,171 (1955).



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BULLETIN A.T.U. has details. Send for a copy.

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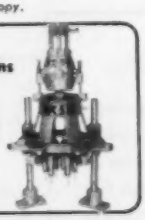
drill or tap millions of hole combinations

More versatile—faster, easier to set up. Three different models—straight line and circle types. Can be used on any drill press. A real time-and-money-saver!

BULLETIN 600A has details. Write



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NEW NAME ANNOUNCED

American Wheelabrator & Equipment Corp., Mishawaka, Ind. has announced that it has changed its corporate name to Wheelabrator Corporation, effective immediately. The move does not involve any alteration in the ownership, management, or operation of the company, which manufactures blast cleaning equipment, dust and fume control equipment, and foundry equipment.

USEFUL LITERATURE CATALOGS, MANUALS

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PROCESSES

Powder Metallurgy: 205

The latest issue, No. 11, of the Metal Powder Press, published by the New Jersey Zinc Co. shows a number of applications of parts made from brass powder. Also available is a publication "The Uses of Brass and Other Nonferrous Powder Parts."

Investment Casting: 206

"Design — With Microcast in Mind," is the title of a new brochure just published by the Microcast Div., Austenal Laboratories. Included is a table of the different alloys that are cast together with the composition, properties and suggested uses.

Design Booklet 53

A new handbook on designing specifically for investment casting has been prepared by Midwest Precision Casting Co. The information in the booklet is of value to designers and prospective users of investment castings. Includes useful metal selection chart and other engineering data.

MATERIALS AND EQUIPMENT

Quick Acting Coupling: 210

A new descriptive bulletin No. 230 on the quick connect-disconnect high flow coupling has been issued by Snap-Tite, Inc. The bulletin describes the coupling, its uses and construction.

New Titanium Alloy: 211

A new bulletin describing the MST 6Al-4V titanium alloy has been prepared by Mallory-Sharon Titanium Corp. The bulletin lists metallurgy and chemistry of the alloy, properties, and recommended heat treatment, forging and welding procedures.

Cylindrical Gages: 212

Complete information is available on a new series of cylindrical gages covering the range from 0.265" to 0.504" in steps of 0.001". Complete details are available from Horberg Gage Co.

Die Design Guide: 213

A new, highly informative, brochure has been issued by Permanent Mold Die Co., Inc. The plant facilities, typical molds and dies that have been made and the special services available are all described and illustrated. Tables of draft angles and shrinkage allowance tables are included.

Dewpoint Indicator: 214

Literature is available from the General Electric Co. on a new portable, manually-operated dew point indicator. The instrument is said to be designed for easy, convenient measurement of the moisture in gases and furnace atmospheres.

Cut-Off Wheels: 215

A new line of cut-off wheels called the B7 line is described in literature published by the Bonded Abrasives Div., The Carborundum Co. The wheels are aluminum oxide resinoid type.

Thermocouple Connectors: 216

Specification Sheet 56, published by Minneapolis-Honeywell Regulator Co. describes Army Navy (AN) thermocouple connectors. These provide a quick and easily detachable connection for one or more thermocouple circuits.

FINISHING

Thin Gage Blocks: 217

For measurements under 0.100, a new line of thin gage blocks has been announced. Known as "Thin Blocks" the new gages range in thickness from 0.090 to 0.010 with accuracies of 0.000004 and 0.000008. Made by the Weber Gage Co., they are of steel and are designed to withstand daily production use. Information concerning these blocks is now available.

Finishing Stainless Steel: 218

Due to an increasing demand for laboratory-verified reports on the surface finishing of stainless steel, Frederic B. Stevens, Inc. has prepared bulletin PP-124 "Successful Stevens L. V. Finishing of Stainless Steel." The bulletin also describes how manufacturers may make use of the company's service laboratory report service.

Fully Dense Chromium Plating: 219

A new technical bulletin CFC-1 has been published by the United Chromium Div. of Metal & Thermit Corp. describing the new Crack Free chromium process. Comparative photomicrographs are shown.

Removing Burrs, Heat Scale and Rust: 220

Oakite compound FM 184, designed for removal of burrs, heat scale and rust in the finishing barrel and to improve the color of steel is described in a new report that has been issued by Oakite Products, Inc.

Buffing & Polishing: 221

A group of five new bulletins has been issued by Hanson-Van Winkle-Munning Co. on buffing, plating, plating equipment and rectifiers.

Plating Room Chart: 222

Frederic B. Stevens, Inc. has issued a standard-sized file folder that can double as a wall chart to give safety first information for the plating room and also serve as a stock record and inventory record of finishing supplies.

Protecting Aluminum: 223

Technical Service Data Sheet No. 7-16-1000-2 has been issued by the American Chemical Paint Co. This report covers Alodine No. 1000, a protective material for aluminum that does not change the appearance of the metal.

Primer for Zinc: 224

Two bulletins have been issued by Neilson Chemical Co. that describe Galvaprep, a primer material for zinc base castings and zinc coated steel. With the material, etching prior to painting is said to be unnecessary.

Chromate Treatments: 225

A reprinted study of various chromate treatments, their advantages and disadvantages is available from Allied Research Products, Inc.

Bright Nickel Processes: 226

Three technical bulletins Nos. NP-514H, NP-41 and NP-31H, have been issued by Udylite Corp. Complete details of each of three bright nickel processes are given.

WHAT'S THE FASTEST WAY TO CLEAN METAL?
See page 11
WHAT'S THE MOST ECONOMICAL WAY?
See page 9
Some good things to know about Metal Cleaning
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Electrolytic Stripping: 227
The electrolytic stripping of chromium, nickel and copper from zinc base die castings is discussed in a report on Enstrip L-88 that has been issued by Enthone, Inc.

Spray Equipment & Paint Heaters: 228
Two bulletins have been published by The DeVilbiss Co. describing their spray equipment for catalyst and additive materials and their paint heating units.

Paint Masks: 229
Pre-cut protective masks in either standard shapes and sizes or specials for your particular job are described in literature from W. H. Brady Co.

Vacuum Metalizing: 230
A highly informative 21 page bulletin on vacuum metalizing has been issued by the F. J. Stokes Machine Co. Described are the process, the materials and where and when this finishing system can be used.

Radiant Heaters: 231
An application report, No. R 148, has been issued by Edwin L. Wiegand Co. The report is a case history showing how radiant heat was applied for preheating prior to painting.

Bright Nickel Process: 232
Bulletin No. 113 from Lea Ronal, Inc. gives all of the technical information needed for the use of that company's bright nickel process.

Vacuum Coating: 233
A laboratory report from Consolidated Vacuum Corp., gives a complete description of the Type LCI-48C vacuum coating unit. Operating conditions are also given.

Buffing & Finishing Compounds: 234
A revised technical bulletin, T-5, describing the complete line of buffing and finishing compounds made by The Globe Compound Co., Inc. has just been issued. Both stick and liquid compounds are covered as are special cutting and coloring materials for stainless steel, special nonferrous metal rouge and other special materials.

Continued on page 102

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INVESTMENT ALLOYS
continued from page 53

4) Metal Purity Inclusions, gas content, internal slag and small concentrations of undesirable elements in the raw material have an effect on the melting characteristics and the performance of the casting.

It is important, in this respect, for the investment caster to examine his raw materials from the viewpoint of the generation of slag during remelting. With most investment casting furnaces it is difficult to remove slag or to keep it from entering the mold. Furthermore, very small amounts of slag can make the temperature readings of radiation pyrometers completely meaningless.

In the preparation of high nickel or nickel base alloys for remelt, it has been found that aluminum deoxidation must be excluded if the material is to be slag free upon remelting. An extremely small amount of aluminum will create a fluid slag which is not only detrimental in itself but under certain conditions will react with the mold material to cause a gross defect in the casting.

It is economically unfeasible for the investment caster to run an analysis on all residuals which might be present in each lot of material. These residuals are not only important in respect to melting characteristics but also influence the mechanical properties of the alloy. In those cases where the investment caster is required to obtain above average tensile strengths and elongations for the alloy, the level of residual concentration may mean the difference between success or failure. Our previous example, AMS 5350C, is an alloy sensitive to composition, heat treatment and residual concentration. The following properties can be obtained when all the factors are carefully controlled:

Tensile strength	193,700 psi
Yield strength	160,000 psi

Continued on next page

now you can get this brilliant finish directly on zinc die castings!

No electroplating--no mechanical finishing!

PART AS CAST

TREATED WITH NEW IRIDITE

NEW IRIDITE® (Cast-Zinc-Brite)

brightens zinc die castings by chemical polishing, protects against corrosion

NOW, FOR THE FIRST TIME you can get a brilliant, decorative finish directly on zinc die-cast parts . . . without mechanical finishing, without electroplating! The luster is provided by the *chemical polishing* action of new Iridite (Cast-Zinc-Brite) solution. Even surface blemishes, such as cold shuts, are brightened by this new process. No electrolysis. No special equipment. No specially trained personnel. Just a simple chemical dip for a few seconds and the job is done. And, this new Iridite has been *tested and proved* in production.

CORROSION RESISTANCE, TOO! New Iridite (Cast-Zinc-Brite) provides exceptional corrosion resistance for bright-type chromate finishes . . . also guards against blueing or darkening by eliminating zinc plate formerly required in bright chromate finishing of zinc die castings.

AS A BASE FOR ELECTROPLATING—Lower mechanical finishing costs are possible where plated finishes are *required* since the brightness provided by this new Iridite may be sufficient.

LET US SHOW YOU what Iridite (Cast-Zinc-Brite) can do for you. Send us at least a half-dozen typical zinc die-cast parts for FREE PROCESSING for your own tests and evaluation. Or, for immediate information, call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified 'phone book. *IMPORTANT: when you give us samples for test processing, please be sure to identify the alloy used.*

Iridite is approved under government specifications

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Chemicals

For more information circle No. 77 on the Reader Service Card

INVESTMENT ALLOYS—cont.

Elongation	13% in 1 inch
Reduction of area	47.9%
Heat treatment	1800°F—oil quenched, tempered for 1 hour at 600°F

The composition of this material is as follows:

Cr 12.67%	Mo .04%
Ni less than .10%	P .010%
C .14%	S .009%
Si .50%	Cu .07%
Mn .75%	Fe balance

With relatively small changes in composition or residual concentrations, the elongation can drop from the 13% value to less than 5%.

5) Availability It is uneconomical for the investment caster to stock his raw materials because of the wide variety of specifications and quantities used. However, he must be able to obtain rapidly, small quantities of remelt alloys within the compositional ranges required.

Most of the quotations which the investment caster makes to his customers require sample castings. Although he may only need 40 or 50 pounds of material, he must have this material in as short a time as possible. Furthermore, this material should be representative of that to be used in production runs.

The short and reliable delivery of special remelt alloys is an important influence in determining the level of raw material inventory maintained by the investment caster, and the service he can give to his customer.

6) Metal Cost The investment caster cannot base his selection of raw materials on initial cost alone. The metal cost per good casting is dependent not only upon the raw material cost but upon the number of rejections, the proportion of gates and sprues, and the value o fhis scrap.

Metal quality is important in insuring a high percentage of good castings.

Differences in initial metal price are insignificant when compared with the expense of rejections in terms of mold, pattern, processing, and labor costs. Since metal cost is such a small fraction of the value of an investment casting, the highest quality material represents an effective means of cost saving.

The precise and unique requirements of the investment casting process has originated a new type of metal supply. The greater proportion of the metal needs of the investment casting industry are custom made, either in facilities associated with the investment casting plant or by special suppliers who are equipped to provide these specific requirements.

With discriminating selection of raw materials, the investment caster has the advantage of working with an exactly known quantity. He is able to obtain in a material sense the same high quality he supplies in dimensional accuracies.

By this emphasis on quality, the investment cast product is unexcelled in the metal industry.

ROTO FINISH
your new opportunity in
controlled precision finishing
Roto-Finish processes are controlled precision finishing operations using low cost mass production techniques, which maintain exact tolerances on most any size or shape precision part with no significant dimensional changes. Roto-Finish speeds production, cuts maintenance expense, minimizes operational costs, yet produces top quality finishing results. Roto-Finish offers latest in controlled methods, materials and special purpose fixture equipment. Roto-Finish is your new opportunity in controlled precision finishing with guaranteed results!
Write for catalog today! Ask about free Lab Testing Plan.
Roto-Finish
3716 Milham Road, Kalamazoo, Michigan
ROTO FINISH
COMPANY
P. O. Box 988
Phone 3-5578

WHITEHEAD HANDLES "MOLY"

Joint announcement of a new distribution program for molybdenum alloys in New England and middle Atlantic seaboard areas has been made by Arthur H. Bunker, president, Climax Molybdenum Company and Clayton D. Grover, president, Whitehead Metal Products Company. Under a new agreement effective October 1, 1955, Whitehead warehouses in the East will stock the full range of foundry alloying materials produced by Climax.

The area to be covered under the distributor arrangement includes all of New England, New York, New Jersey, Delaware, Maryland, Virginia and the eastern part of Pennsylvania.

For more information circle No. 90 on the Reader Service Card

to get any of the free materials described here, circle the appropriate number on the reader service cards bound into this issue

PRODUCT NEWS AND DEVELOPMENTS

SMALL PARTS DRYER with 75 lb. capacity dries load in 15 seconds

A new centrifugal small parts dryer with a capacity of 75 lbs. has been announced. According to the manufacturer the new machine can dry a full load in at little as 15 seconds.

The high speed drying is due to an improved exhaust system which allows the moist air to pass completely out of the dryer, rather than be blocked in the bottom of the machine.

Operating at 825 rpm, the initial drying is accomplished by centrifugal action. Air is drawn through the load by a turbine located below the basket. To further increase the rate of drying, the incoming air may be preheated with either steam coils or with an electric heating unit located in the dome of the machine.

New Holland Machine Co.
For more information, circle No. 256 on the Reader Service Card.

VACUUM DEGASSING UNIT for use with molten metals improves casting quality

Dissolved gases in metals are one of the causes of poor quality castings. Of the many methods of dissolved gas removal the use of a vacuum degassing chamber has proven to be one of the most effective.

A new unit is now on the market that can handle up to 1000 lbs. of molten metal in either ladles or crucibles. Degassing is done at pressures as low as 200 microns, depending on the metal being treated.

The unit is furnished complete in all details so that only electric power, water and drain connections need to be made to put it into operation.

The Centrifugal Casting Machine Co.
For more information, circle No. 259 on the Reader Service Card

PAINTING & WIPING combined in one machine for fast production

A new machine, that combines painting and wiping with only one loading of the part, has been developed.

Basically the machine, Model 7000, is a combination of a part-rotating spray painting machine, and an automatic paint wiper. The unit has six holding nests, one of which is used for loading. The first indexing of the part is to the painting station, where it is raised into a mask, rotated, and sprayed with a band of paint that covers all depressed letters, numbers, etc.

The part is then indexed to the wiping station, where it is again raised and spun into the towel which wipes it, removing all paint except from indented areas. The continuous roll towel may be washed and re-used over and over.

Including time for mask cleaning, the production of the machine is from 900 to 1300 pieces per hour.

Finish Engineering Co., Inc.
For more information, circle No. 257 on the Reader Service Card.

ADDITION AGENTS
. . . for zinc electroplating

A series of addition agents for cyanide zinc plating, tailor-made to suit the particular needs of individual operators, has just been introduced.

Marketed as the Zimax Series, these addition agents are the result of years of development. The members of the series are characterized by their ability to produce clear, bright deposits directly from the bath and increase the covering and throwing power of zinc baths. Containing no metallic components, they are more economical than previously available materials.

Zimax brighteners are said to offer an ideal base for postplate conversion coatings, as well as giving a bright finish direct from the bath.

Federated Metals Div.
American Smelting & Refining Co.
For more information, circle No. 262 on the Reader Service Card

BURST-PROOF HOSE
. . . with grease resistant cover

A new burst-proof steam hose line with longer life, greater efficiency and maximum safety is now available with a grease-resistant cover for special applications.

The steam hose line is a matched combination of special fitting and burst-proof steam hose.

The design of the fitting is said to give assurance that steam hose line problems are solved. Once installed, the fittings need no tightening or adjustment. If the hose is damaged in service, only a new length of hose is necessary to repair the line right on the job.

The rugged construction of the hose virtually eliminates the danger of bursting under normal usage. The hose can be used anywhere for applications up to 200 lbs. pressure (388F)

Aeroquip Corp.
For more information, circle No. 263 on the Reader Service Card

PORTABLE LIQUID FILTER
. . . for lab. and pilot use

Increased filtering capacity in a compact space, simplified operation and quick, convenient maintenance are claimed for the new portable "Streamliner" filter recently introduced.

Designed for use in the laboratory, small production shop or pilot plant, the filter has a capacity of 250 GPH and can be used with several different types of filter media. The unit is 14" high and 14" square at the base. It weighs only 45 pounds and can be used for either acid or alkaline solutions.

The improved design allows complete cleaning of the filter in as little as five minutes. By using a disposable filter cartridge over the standard stainless steel annular element the unit can be used without any filter-aid. This makes the recovery of precious metals from the filter cake much easier and simpler. With the disposable paper filter cartridge, cleaning time is cut up to 90 percent.

Bart-Messing Corp.
For more information, circle No. 264 on the Reader Service Card

TITANIUM ADDITION AGENT
. . . of higher purity

A new metal, designated as Titanium Metal-Grade NDA, has a minimum of 97 percent titanium, a maximum content of three percent iron, .20 percent of nitrogen, .15 percent carbon and 75 parts per million of hydrogen. The price has been reduced from $2.25 and $2.00 per pound to $1.75 and $1.50 per pound of pellets and fines respectively.

The pellets are furnished about one-half inch in diameter and one-quarter inch thick, they are unsintered. The fines are all minus 14 mesh particles.

E. I. du Pont de Nemours & Co., Inc.
For more information, circle No. 265 on the Reader Service Card

SPEED UP PRODUCTION with DOUBLE-ACTION DRYING

Air-dry as you spin-dry with the new, improved New Holland Model 20 KREIDER CENTRIFUGAL DRYER

• Now you can *spin-dry* small parts in continuous *fresh air* in as little as 15 seconds.

Double-action drying with peak-efficiency evaporation gives smooth moisture-free surfaces . . . reduces your finishing problems by eliminating the scarring frequently responsible for costly "rejects."

Your operators will be able to boost production, cut costs way down when you install New Holland's easy-to-run Model 20 Kreider Centrifugal Dryer.

SAFER because of Mechanical and Electrical Control Features!

To unlock cover and remove basket, operator must depress foot brake, stop spinner.

Machine cannot start with open cover. Ample clearance allowed for quick loading.

To start spinner, operator must first close cover completely.

SPECIFICATIONS:
1 h. p. motor—220, 440, 550 volts—2- or 3-phase—spins 75-lb. loads at 825 r.p.m. . . . Quiet V-belt drive . . . 30-blade suction turbine draws air through spinner . . . . Arc-welded steel-plate construction . . . Heavy-gauge woven steel mesh basket . . . Weight: 490 lbs. . . . Floor space: Just under 5 sq. ft. . . . Meets N.F.C. specs. **Optional:** J.I.C. Control: Mounted on right, left side or wall. 160° supplementary heat: 2350-watt Chromalox, or steam.

Send for illustrated 4-page folder. Address Dept. PM-1055
New Holland Machine Company, New Holland, Pa.

NEW HOLLAND MACHINE COMPANY
NEW HOLLAND, PA.

For more information circle No. 87 on the Reader Service Card

METAL REMELTER
. . . for use below 1000F

A metal remelter that is said to provide efficient, rapid melting of metals and alloys that melt below 1000F has been developed. Unlike other remelters, the crucible and the exterior housing of the remelter is square or rectangular in order to conserve floor space. The furnace is charged from the top through a fully insulated hinged cover. Pot capacity of the remelter ranges from 600 lbs. to 10,000 lbs.

A feature of the remelter is a drip-proof, bottom pouring valve seated within the pot to allow for expansion and contraction. The self-lapping valve is located inside the crucible so that it is subject to maximum temperatures at all times. This eliminates the possibility that the valve may freeze.

The remelter uses electricity, gas or oil as fuel. Depending on the fuel used, the unit requires about two hours to melt a full pot from a cold start. Recovery time for additional loads is about one hour.

Nolan Corp.
For more information, circle No. 258 on the Reader Service Card.

ROTARY SPRAY-PAINT MACHINE
. . . for round and deep-drawn parts

The painting of round and deep-drawn parts which have been very difficult to hand spray because of their intricate design, is now easy and economical with a new automatic rotary spray-painting machine.

According to the manufacturer, the flexibility of the machine makes it readily adaptable for decorating a wide variety of parts such as hub caps, toys, nameplates and emblems. It will handle areas up to 15 inches.

Operation is said to be extremely simple. The piece is put into a mask and the foot pedal or hand valve depressed. The part is automatically clamped into the mask, to the desired pressure, the guns operated to a predetermined setting and the clamping cylinder retracts after the cycle is completed. The guns rotate beneath the mask, or they may be used in a fixed position.

Conforming Matrix Corp.
For more information, circle No. 260 on the Reader Service Card

IMPROVED COUNTERSINK
. . . for fast deburring

A newly engineered tool for fast, efficient and economical deburring and chamfering of openly accessible hole faces has been developed.

The new tool with its higher rake angle produces a greater shear or shaving action which promises a longer life between grinds. The shaving action is accomplished with a minimum of pressure so that a secondary burr is not developed.

A simplified, inexpensive sharp-

Continued on next page

"Martin Grinding Manufactured these for Doehler-Jarvis!"

Betty, the Martin Girl, is holding a sprue bushing 2" long with a 2" O. D. x 1½" I.D. All tolerances held within .0005 of an inch.

This represents just one of the smaller parts made by Martin Grinding and Machine Works for the die casting industry.

Alongside Betty, is one of the larger parts manufactured complete by Martin Grinding for Doehler-Jarvis. Dimensions of sleeve are as follows:

LENGTH —36"
O.D. — 8"
I.D. — 3½"

It has been made from one of the better grades of hot worked steel, which in turn was hardened, ground and nitrided for longer life. It is then polished to fit the mating part as specified by the customer.

Just goes to prove that big or small Martin Grinding and Machine Works can furnish you with the best.

We welcome all inquiries re: the reconditioning of cold shot sleeves and goosenecks as well as the complete fabricating of same.

Send for Brochure and facility list. Dept. R2

Martin grinding and machine works inc.
2234 W. Walnut St. Chicago 12, Illinois SEeley 3-2154

For more information circle No. 54 on the Reader Service Card

circle No. 80 on the Reader Service Card

CUT FINISHING COSTS THROUGH INCREASED PRODUCTION

Send for Free Literature Now!

SPRAY PAINTING MASKS
A competent engineering staff will counsel with you on the most efficient technique for handling your particular requirements.

PRODUCT DEVELOPMENTS BY C-M CONFORMING MATRIX

AUTOMATIC MACHINES
Increase production hundreds to one over hand methods. Reduce labor costs. Eliminate need of experienced workmen.

CLAMPS AND FIXTURES
Positive pressure and exact registration of the part in the mask. Reduce rejects. Free both hands for productive movements.

MASK WASHING MACHINES
50% faster than any other make. Cut solvent consumption. Avert production delays due to damaging of masks by hand scrubbing.

CONFORMING MATRIX CORPORATION
346 TOLEDO FACTORIES BLDG.
TOLEDO 2, OHIO

ening procedure permits the user to reestablish original factory performance and to perform such regrinds many times over without altering the performance.

The tool is available with a 90° included angle and is made from high speed steel, carefully heat-treated and precision ground.

Nobur Mfg. Co.
For more information, circle No. 261 on the Reader Service Card

LABORATORY DIE . . . for powered metal test bars

New tools for making standard test specimens of various powdered metals and other powdered mixes have recently been developed.

Completely self-contained, the tools employ a reverse stripping principal to eliminate chipping or nicking the parts during ejection, and a floating die insures optimum density distribution throughout the part being pressed.

The tools are made for use in any 30 to 50 ton laboratory press and are fast, efficient and simple. Constantly uniform compacts, essential in testing powdered metal parts, are easily produced without special knowledge of die set-up procedure.

The standard die shapes include tensile bars in accordance with Metal Powder Association Standard 10-50. Other dies, for making transverse rupture and green strength specimens are available; these meet the MPA Standard 1351.

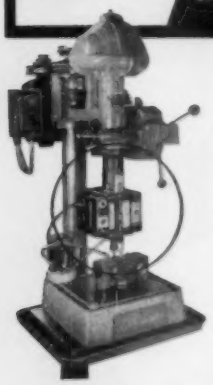
Haller, Inc.
For more information, circle No. 268 on the Reader Service Card

PORTABLE PYROMETER . . . measure surface temperature

For measurement of surface temperatures in the range of from 100F to 2400F, a new type of portable pyrometer, with a reported accuracy of 0.5 percent, has been

TIPS for PROFITABLE TAPPING

Commander LEAD-MATIC TAPPER



High Production Automatic Lead Screw Tapper

Put a Commander Lēad-Matic Tapper on any drill press and you're ready to handle any tapping job — precision or otherwise. Designed to handle a very wide range of taps, Lēad-Matic operation is simple and foolproof — even inexperienced operators produce precision threads. The Lēad-Matic's electrically controlled cycle or jog tapping actions provide versatility to handle any job. Ruggedly built for trouble-free service.

Features That Help You Tap Better

- Precision ground lead screws insure finest threads.
- Automatic tap reversal — no drill press motor reversing — faster work.
- Hand, foot or fixture switch controls.

Your nearby Commander Distributor has the Lēad-Matic see it soon.

Commander MFG. CO.
4213 W. KINZIE ST., CHICAGO 24, ILLINOIS

For more information circle No. 20 on the Reader Service Card

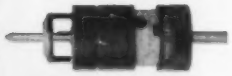
First and Foremost NOBUR'S Job Tested TEAM for ★ DEBURRING ★ CHAMFERING

the NOBUR

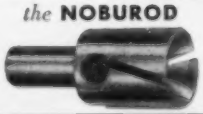
for machine deburring and chamfering of line-drilled and otherwise inaccessible hole surfaces.

for the automatic deburring and chamfering of front and back hole faces simultaneously in sheet metal, etc.

the NOBURMATIC



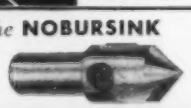
the NOBUROD



for rapid deburring and chamfering the outer ends of rods, tubes and bosses.

for rapid deburring and chamfering openly accessible hole faces.

the NOBURSINK



NO/BUR TOOLS NOBUR MANUFACTURING CO.
6860 Farmdale Ave., No. Hollywood, California

For more information circle No. 85 on the Reader Service Card

introduced. This accuracy compares with 5 percent accuracy for existing instruments.

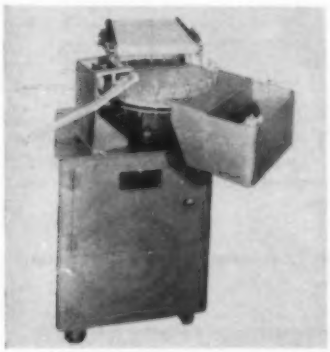
The new instrument is of the radiation type with a head, which is concave in shape, produces near perfect black body conditions. Under these conditions the output of the radiation head can be connected directly to a milli-voltmeter type of indicator so that an outside power source is not needed.

Because the instrument operates in the infra-red end of the spectrum it actually measures temperatures below the surface, on metals about 3/16" below surface and on refractories about 1/16" below surface, thus local cooling and skin effects are minimized.

Robertshaw-Fulton Controls Co.
For more information, circle No. 269 on the Reader Service Card

PAINT WIPING MACHINE ... eliminates hand labor

The tedious and time-consuming method of hand wiping of stove, heater, refrigerator, etc. knobs after spray painting or dipping, has been made unnecessary by a newly developed automatic, rotary wiping machine, according to the builders.



The machine provides for high production wiping after mask controlled spraying which holds the paint to the immediate area.

A variable speed table mounts 24 revolving work holders and permits production rates of from 700 to 3600 wiped pieces per hour.

The operator sits at the machine and loads the parts from a hopper. The parts moving under the wiping cloth are revolved until clean and are then removed from the spindle by an automatic unloading device.

Conforming Matrix Corp.
For more information, circle No. 270 on the Reader Service Card

PIP push inserts offer READY-MADE FEMALE THREADS WITHOUT DRILLING OR TAPPING

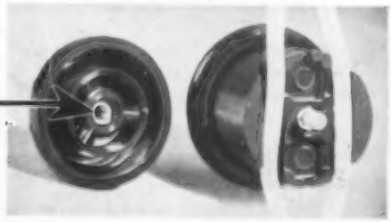
Amazing new techniques now permit the insertion of *ready-made, self-anchoring female threads* in molded plastic parts, die-cast alloys, powdered metals and other soft, light materials—*without costly drilling or tapping.*

Heli-Coil* PIP push inserts have been developed by the Heli-Coil Corporation over years of exhaustive research and testing. These PIP push inserts are pushed directly into cast or molded, blind or through-holes. They provide female threads for standard industrial specifications of thread fit (usually Class 2), often *at less than one cent per thread installed.*

For most production needs, tooling consists merely of a PIP mandrel, which is no larger nor more complicated than a drill or reamer. The mandrel can be used in any device having suitable stroke for pushing the PIP insert into the hole...a drill press, kick press, arbor press, or air piston will do. No rotation is needed. *A few dollars in tooling is all you need to set up for about 1200 holes per hour—per mandrel!* There is also available an automatic hopper-fed PIP push insert machine for use in quantity runs.

Send the coupon below for your free copy of our Standard PIP push inserts Application Chart. This unique chart will enable us to discover quickly without a salesman's call, whether *Heli-Coil* PIP push inserts will save you time and money. We maintain a top-flight staff of thread engineers and, if PIP push inserts are applicable in your case, we'll be glad to consult with you.

Electrical socket cap shows successful application of *Heli-Coil* PIP push inserts. Female thread in cap has sufficient strength to impale two covered wires on contact prongs.



For high-strength applications, we recommend the use of standard Heli-Coil Screw Thread or Screw-Lock Inserts.

HELI-COIL CORPORATION
510 SHELTER ROCK LANE, DANBURY, CONN.

☐ Send Standard PIP push insert Application Chart and other information on this new technique.
☐ Send design data on *Heli-Coil* Screw Thread Inserts.
☐ Send design data on *Heli-Coil* Screw Lock Inserts.

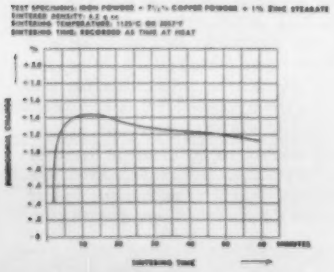
NAME_____ TITLE_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE____ STATE_____ 1093

*Reg. U.S. Pat. Off.
Heli-Coil Corporation: Manufacturer of *Heli-Coil* Screw Thread Inserts, *Heli-Coil* Screw Lock Inserts and *Heli-Coil* PIP push inserts.
For more information circle No. 83 on the Reader Service Card

COPPER ADDITIONS
continued from page 57

temperature was raised to 1125 C (2050 F.), and held there, so that total time for the specimen in the furnace was the same in all tests. A slowly heated specimen will develop smaller dimensions than one which is heated rapidly to sintering temperature, or, in other words, a lower heating rate causes more shrinkage and smaller final dimensions.

We believe this has to do with the time the specimen is held in a temperature range around the melting point of copper. Figure 10 illustrates this more clearly. The test specimens were prepared as explained above. The sintering was divided in two temperature stages and we can see, that the dimensions have a marked minimum when presintering is done around the melting point of copper.



8. CHARACTERISTIC relationship between sintering time and dimensional change for an iron copper mixture.

4. *Cooling rate.* The cooling rate, no doubt, is of importance for the properties of the part, but will not be considered in this paper, as it is more closely related to the heat treating properties of iron-copper alloys. The cooling time in all presented investigations was about 15 minutes if not otherwise stated.

5. *Screen size of the powders.* Generally speaking, the finer the mesh size of the powders, the smaller will the dimensions of the part be after sintering. This phenomenon seems to apply not only to iron-copper mixtures, but to other powder combinations as well.[11]

6. *Other additives.* Addition of a third component to iron-copper mixtures will have a more or less radical influence on the ultimate dimensions. Although we have not as yet discussed the mechanism of copper growth, it should be mentioned that one can expect to influence copper growth by additions that change the amount or duration of the liquid phase by:

(a) Changing copper solubility in iron.

(b) Changing iron solubility in copper.

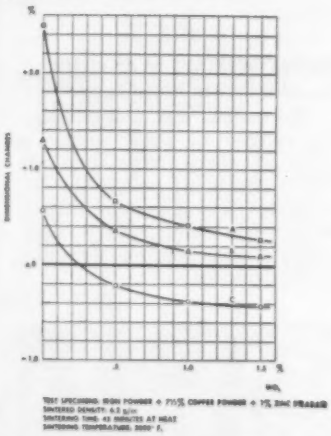
(c) Changing the surface tension of the molten copper phase, etc.

Decreasing copper solubility in iron is accomplished with perhaps the most common additive, carbon (graphite), which decreases copper growth of all iron powders, especially those which normally show a high copper growth. Carburizing sintering atmospheres should have the same influence, although this has not been studied.

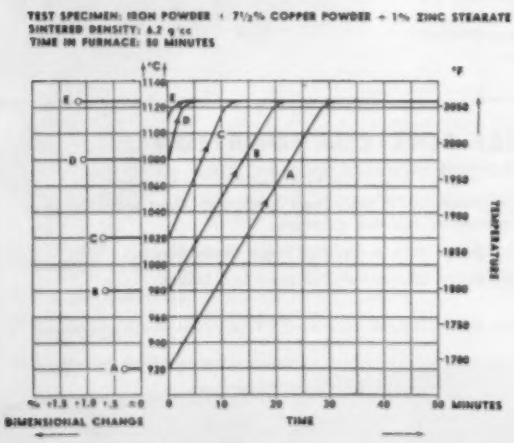
Small additions of tungsten oxide will considerably decrease copper growth for all irons; more so for irons with high normal copper growth. This is shown for A, B and C-irons in Figure 11. The mechanism in this case is not fully clear.

Ferro-phosphorous additions will increase the amount of liquid phase and thereby decrease copper growth.

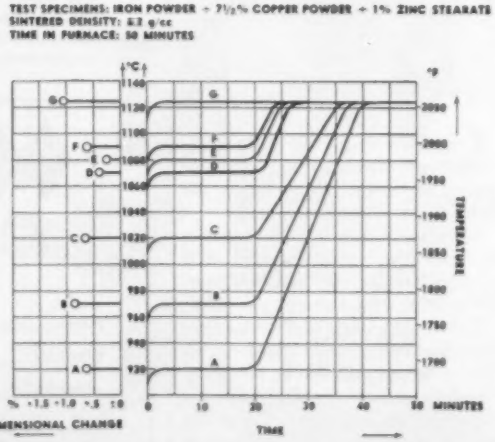
The second, and concluding part will appear in Precision Metal Molding for November. Bibliography will appear next month.



11. EFFECT OF SMALL ADDITIONS of tungsten oxide (WO_3) on the dimensional changes of iron-copper mixtures.



9. EFFECT OF HEATING rate on the dimensional change of an iron-copper compact; uniform heating rate up to the sintering temperature.

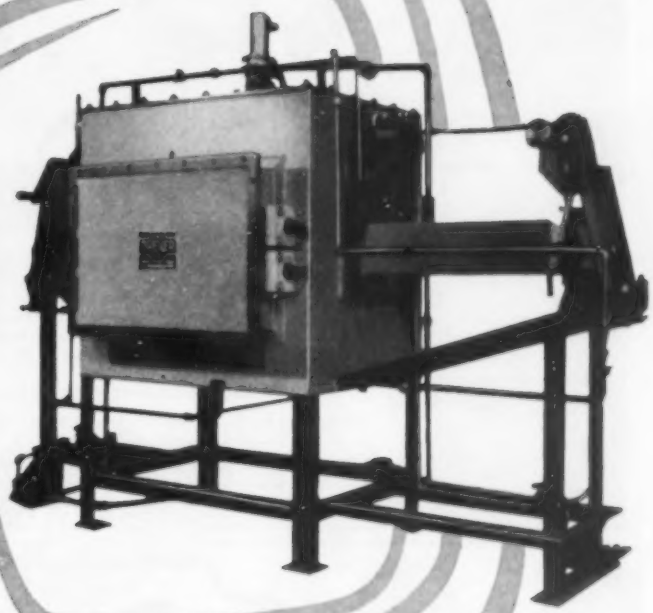


10. EFFECT OF HEATING rate on the dimensional change of an iron-copper compact when presintered near the melting point of copper.

DREVER

Batch Type

Sintering Furnaces



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DIE CASTING SMALL PARTS

DRILLING & TAPPING
continued from page 75

speed for drilling zinc alloy with high speed steel drills, or 100-150 ft. per minute with carbon steel. Aluminum drilling is suggested at rates up to 600 peripheral feet per minute with feeds of .002 to .010 per revolution. Exact choice of feed and speed depends upon the tool engineer's experience with any given tool material, tool shape and workpiece material.

If grabbing of the drill becomes a problem, solutions found in some shops include grinding a flat along the lip for zero or slightly negative rake or increasing the drill speed.

Plenty of lip clearance is desirable, so flutes larger than normal are an advantage. Special thin-webbed drills with wide flutes and narrow lands are available from some manufacturers, specifically for work on die castings.

Sometimes cutting lubricants are used to help keep the work

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No. 2	1¼" Screen	⅞" Screen
No. 2A	1¼" Screen	1" Screen
No. 2B	1" Screen	⅞" Screen
No. 3	⅞" Screen	⅝" Screen
No. 3A	⅞" Screen	¾" Screen
No. 3B	¾" Screen	⅝" Screen
No. 4	⅝" Screen	5/16" Screen
No. 4A	⅝" Screen	½" Screen
No. 4B	½" Screen	5/16" Screen
No. 5	5/16" Screen	⅛" Screen
No. 5A	5/16" Screen	3/16" Screen
No. 5B	3/16" Screen	⅛" Screen

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and tool cool and chips flushed out, but this is not essential and many good jobs are run dry.

Tools and Practices for Tapping

To get smooth threads, ground taps are usually preferred, although standard taps can also be used. Spiral-point taps, sometimes called gun taps, are used for through holes not more than two diameters deep, while straight fluted taps nearly square on the end are used for blind holes where the thread must approach bottom.

High speeds are generally recommended, and lubricant helps to produce good quality, clean threads. Frequent sharpening (one manufacturer recommends resharpening spiral-point taps after 2,000 holes) will contribute to good quality tapping.

Rake of 12° to 15° is considered good practice. Anything that reduces friction and galling improves thread quality, so some taps have the land narrowed down drastically to reduce friction.

Lead screw tapping is becoming more common, and at least one manufacturer recommends that tapping always be done with lead screw to minimize tap breakage, imperfect threads and to give better control of blind hole tapping. Lead screws are now being incorporated into some tapping heads.

Two At A Time

The economic feasibility of any particular type of equipment can be determined readily by cost engineers, based upon allowable money to be spent in tooling a given job. Some manufacturers insist upon setting up sufficient equipment to produce twice the requirements, to allow ample time for tool sharpening, maintenance, inventory, etc.

One builder of drilling equipment recommends grouping parts two at a time. His theory: you can double the number of pieces while increasing tool costs only one-quarter or one-third. Furthermore, since the greatest time factor is loading and unloading, a great deal of time can be saved by loading a second piece while the first is being drilled or tapped. More than two pieces can also be grouped for efficiency, but it has been suggested that even numbers of parts should always be processed together: odd numbers of parts break the rhythm of handling and reduce efficiency.

Inexpensive indexing work tables are also recommended as a means of stepping up production, with more than one loading station. Likewise, air cylinders (counterbalanced usually by another cylinder which smooths the approach and feed) will multiply the output in any given setup.

While there is some indication of completely automated setups, with work progressing from station to station of specially-designed units, this is still largely a future prospect. An exception is the processing of a typewriter frame, shown in Case No. 2 on the following page.

So far, the average die casting is small enough so that handling from fixture to fixture or station to station is not a great problem. As casting sizes increase, and number of operations become greater, then perhaps more especially-built transfer machines will become practical.

Typical Jobs Today

Typical of high production drilling and tapping of die castings are: a typewriter frame that has 56 holes at six different angles to be drilled, reamed and tapped;

Continued on next page

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DRILLING & TAPPING — con't.

an automatic regulator for hot water tank that requires 64 spindles to drill and tap all surfaces; a movie projector frame with 50 holes, nearly all small diameter; an oil valve body for an automatic transmission that has many holes cored, but still needs 24 drill heads and 24 jigs for drilling.

There is no limit to the number of holes that can be drilled simultaneously. One large builder of automatic machines simultaneously moves multiple spindle heads from three sides to put nearly 100 holes in a business machine housing. A manufacturer of gearless drill presses reports units that drill as many as 1000 holes at a time with close center distance accuracy.

One of the very practical methods of simplifying tooling on single hole drilling, as contrasted to these mammoth installations, is to have the die caster spot the holes with a shallow countersink. Then, without elaborate jig or machine, the operator can drill holes with reasonable accuracy.

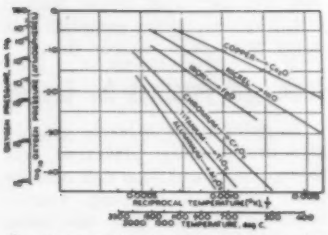
In summary, it is apparent that drilling and tapping of die cast parts present no mechanical difficulties; are very often less expensive and more accurate than attempting to core the same holes; and procedures have become well established so that good quality holes and threads can be produced at high rates of production.

THANKS ARE DUE: The editors of PMM acknowledge the assistance given by the following companies—The Bellows Co., Delta Power Tool Div. of Rockwell Manufacturing Co., The Dumore Co., Howe & Fant, Inc., New Jersey Zinc Co., and Zagar Tool, Inc.

VACUUM MELTING
continued from page 47

The elimination of the effect on mechanical properties is but one benefit from the elimination of porosity. Nitrogen, oxygen and hydrogen as primary or secondary compounds in the metal can have a considerable effect on ductility and strength properties.

The high temperature alloys and high chromium steels are examples of alloys particularly



4. EFFECT OF TEMPERATURE on dissociation pressure of various metal oxides (Lustman).

effected. The work on wrought alloys has demonstrated the considerable improvement in these properties that vacuum melting can give the same types of alloys in cast form have been giving promise of similar improvement in strength and ductility.

Certain physical properties, such as high conductivity in copper, may be retained while getting a sound gas-free casting because no metallic deoxidizer is required, and therefore no residual deoxidant is left in solution to affect the property.

The elimination of the use of slags, and of dross accumulation offers a better surface quality and soundness through the elimina-

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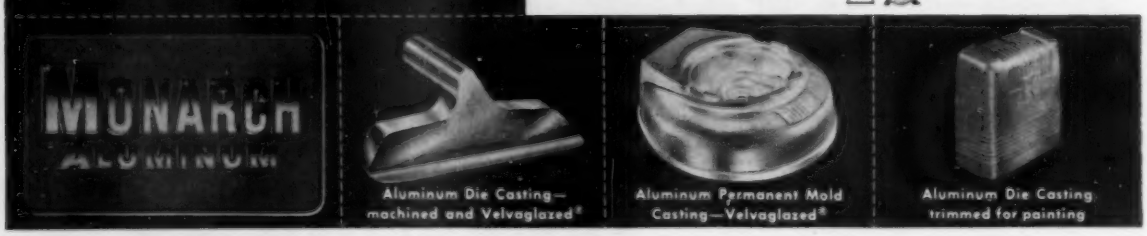

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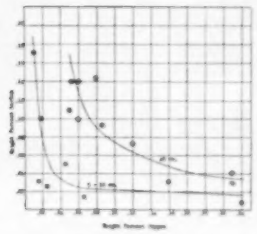
tion of films carried into the casting. Many of the elements which can cause hot shortness in alloys and consequent tearing of the casting, are removed by vacuum melting, particularly the low melting metals and certain non-metals.

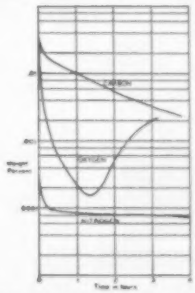


5. PRELIMINARY DATA on the effect of CO pressure on the equilibrium between carbon and oxygen in molten chromium at 2000 C.

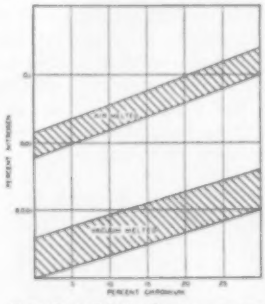
In the production of wrought alloys, it has been demonstrated that the elimination of oxidation and slagging losses gives a much closer heat to heat analytical reproducibility than air melting. Furthermore, in an alloy like beryllium copper, a considerable saving in a costly and strategic alloying element can be effected. Beryllium loss in melting is decreased from about 10 percent to a fraction of a percent.

By the minimizing of the combination of very reactive metals like titanium and aluminum with oxygen and nitrogen during melting, it has been possible to go to higher alloy contents, with a consequent increase in strength properties and maintenance of a usable ductility level. Such alloys as the precipitation harden super alloys and new iron-aluminum alloys are particular examples.

While promising results have been obtained to date in experimental vacuum melting and precision casting, the development of a sound production technique is required, from both the technical and economic standpoints. The application of vacuum refining promises to eliminate certain process variables, but it also, undeniably, introduces a more complex process and equipment.



6. MELT REACTION curves for nickel.



7. COMPARISON of nitrogen content of air melted and vacuum melted low carbon steels containing chromium.

Equipment such as that shown earlier is entirely adequate for the research and development stage, but uneconomic for production. A production cycle comparable with present operations must be obtained, either by fast

Continued on next page

When is a semi-finished casting . . . *finished?*

When Monarch produces semi-finished castings for your subsequent operations, product end-requirements are carefully studied to help you achieve lowest end cost. Monarch's wide experience in complete finishing, underwrites your operations from the very first casting produced. Check this unique *"Value Analysis"* approach to *immediate savings* on present and potential products. Monarch's one-source experience saves for you—all the way down the line.

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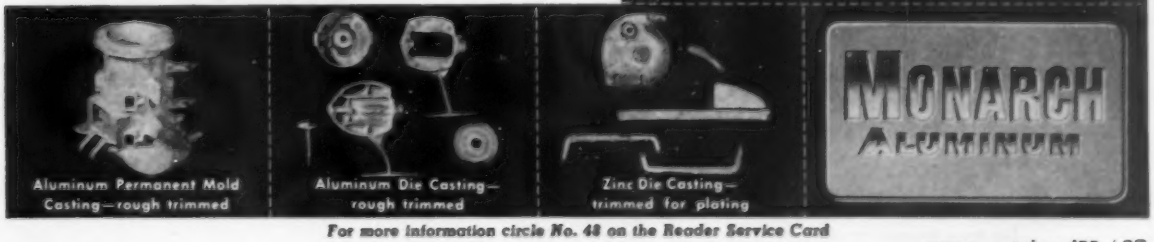
Zinc Die Castings plated and assembled by customer



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cycle small units or a large unit handling a multiple mold line. Modifications will probably be required in such steps of the process as precoating and mold firing to avoid gas evolution problems in vacuum operation.

A question which has not yet been resolved, is that of the use of a large vacuum refine master heat versus smaller heats refined at the time of casting. It now appears that some precision casting problems may be solved by making small investment heats under a protective atmosphere, using a master melting stock which had been vacuum refined. It is probable that, for other alloys, optimum results can be obtained only if either the investment heat is also under vacuum, or if refining and casting are done in one heat. The primary criteria for the choice between these alternatives are the relative manufacturing costs and reproducibility in results. Much work needs to be done yet to resolve this production picture.

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Easton's RZ atomization process symbolized here is giving users quality and cost advantages they never guessed could be obtained in this country.
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METAL IMPROVEMENT
continued from page 47

increases in tensile and yield strength. This high purity iron will serve as an excellent base for investigating new alloys or established ones.

6. Bearing Alloys

The service life of bearings and springs is often dependent on the fatigue strength of the alloy from which they are made. Fatigue strength in turn is closely related to metal or alloy cleanliness. Bearings made from 52100 steel have shown a four fold increase in service life—and a large auto manufacturer plans to use vacuum melted steel for valve springs.

7. Tool and Die Steels

Dirt or other inclusions in tool and die steels adversely affect surface finish, impact strength and fatigue strength. Since vacuum melting produces cleaner steels, it is reasonable to assume that superior tool and die steels will also be made.

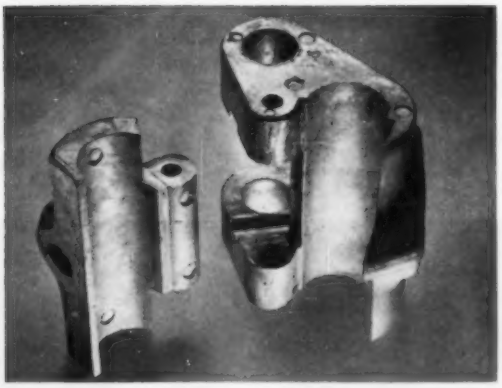
TYPICAL ALLOY ANALYSIS
(Weight — %)

	M-252	J-1570
C	0.15	0.20
Cr	19.0	20.0
Ni	55.0	28.0
Co	10.0	38.0
Mo	10.0	—
W	—	7.0
Ti	2.5	4.0
Al	1.0	—
Fe	2.0	2.0

TABLE I

8. Corrosion Resisting Alloys

The presence of surface imperfections or inclusions in parts made from conventionally melted alloys often lead to galvanic corrosion or pitting during service. Overall corrosion resistance is often a function of purity as in the well known case of aluminum with hydrochloric acid. It is expected that vacuum processing may furnish substantial improvement in the corrosion resistance of various metals and alloys. In some borderline applications it may render a less costly material suitable. In other applications it may markedly lower maintenance costs.



Die Cast Bushing Blocks Are Standard Components

USUALLY, when a machine is designed in which one or more components is to be die cast, these components are either designed originally as die castings or are redesigned from some other method of fabricating.

However, in certain instances, *machines* are designed or redesigned to make use of existing die cast components. Strange as it may seem, this is the actual practice at the C. B. Cottrell & Sons Co. of Milwaukee, large manufacturers of rotary printing presses. Some die castings are standard components used in all models.

The original design of the printing press had ink roller bushing blocks made of cast iron. In the normal course of progress, they were changed to die castings as a manufacturing economy.

Since that time, the presses have been changed, enlarged, modified, etc. and always any new press design is such that the same die cast bushing blocks can be used.

On each machine there are five rolls per color that transfer the ink from the reservoir to the plate. Since a minimum number of colors is two and the maximum five, there are from 40 to 100 bushing blocks used per machine.

As cast by the Badger Die Casting Corp. the blocks require one drilling and tapping operation to complete them.

Because the service is severe the zinc alloy is not used as a bearing surface and separate bronze liners are used.

The change from cast iron to a die casting was made so long ago that no cost figures are now available. It is known, however, that the die castings, ready to install in a press, are far less costly.

One of the most notable improvements that the change brought about has been the elimination of the machining of cast iron. This job is always dirty and where it is practiced good housekeeping in the shop is virtually impossible. This, alone, justifies a different material.

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LITEMETAL DICAST, INC., is an organization of specialists—men thoroughly experienced in the casting and machining of magnesium and aluminum alloys. Our equipment includes big machines for big jobs—little machines for little jobs . . . the right sizes and types of the most modern die casting equipment for producing parts from the size of a button to large structural parts. Complete facilities for secondary operations are also available.

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Precision Castings

IN THE FOUNDRY, the mold is being poured with steel. Note the combination of Ceramicast drag and sand cope mold assembly.

VARIETY OF PATTERN equipment used includes: 1) Metal plus plaster, 2) All metal, 3) All wood, 4) Jobbing wood in clay.

FRESHLY STRIPPED from the pattern, the mold is shown ready to be set aflame.

CLOSEUP shows the stage of pouring the molding material onto the pattern.

The Process . . .

ORIGINALLY developed in England, this process has been the subject of considerable interest in this country. Description of the process has been provided for PMM by the foundry.

Edward Vogel, Research Engineer, who returned to this country a year ago, after working with Shaw Processes, Ltd., London, England, first set up a pilot plant operation in the Research Department of Lebanon Steel Foundry. In recent months this operation has been developed into production of castings by this method on a full time schedule.

The Ceramicast mold is composed of two principal components:

(1) A refractory grog of specific screen analysis.

(2) Ethel silicate liquid binder.

These materials when mixed will set at a certain speed, as controlled by the amount of an added catalyst. This refractory slurry, which requires less than a minute mixing time, is immediately poured on the pattern. Under conditions of proper control the mold can be srtipped from the pattern immediately following investing.

After pattern removal, the mold is immediately placed on a true level grid and set aflame by high temperature gas torches. By so doing, a very smooth casting surface is developed. The mold will support combustion for a short time dué to its alcohol content.

In order to insure entirely gas free molds, they must be heated in excess of 1000 F. for 30 minutes per inch of material thickness. In addition to being gas free, these molds are very resistant to metal erosion and yet will not resist freezing contraction. As a result, these castings are internally clean and without hot tears.

In Ceramic Molds: A New Process

LOW cost patterns and short lead time are important features of a new precision casting technique called the Ceramicast (R) process, introduced in this country by Lebanon.*

This process, using a split type mold made of fine mesh ceramic material, has been in production for some time now on such pieces as stainless steel pump impeller castings for the chemical industry, blading for land gas turbines and components for food processing equipment.

Wood, plastic or metal patterns can be used successfully with this process to yield castings of close accuracy and good surface finish. Since the mold material is poured over the pattern in the form of a liquid slurry, there is negligible wear on the pattern surfaces, assuring accuracy and uniformity over extended runs.

On the other hand, the company reports that low pattern costs permit design changes quickly and at very little expense. This favors the use of the process in prototype work, where design changes are common, and also in certain industries such as the aircraft field, where frequent design changes make components obsolete.

Here are some of the features of this process which will be of interest to designers and buyers of castings:

Accuracy: Where dimensions lie wholly within one half of the mold, tolerances run from .003 to .005 per inch, while those that lie across the mold parting line are usually within the range of .006 to .010 per inch.

Shape and size: Intricate design and detail are possible, including shapes requiring coring. Size is described as virtually unlimited, with the possibility of castings weighing several hundred pounds.

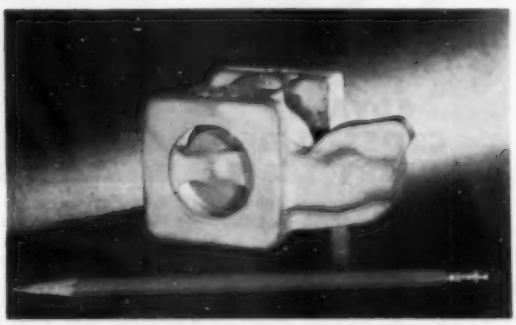
One particular design feature worth noting is the ability to produce castings with knife edges. It is also possible to produce section thicknesses of 1/16" over a span of several square inches.

Alloys: This process is being used for casting ferrous alloys. Any type of steel can be cast, including not only the carbon steels and conventional low alloys, but also the nickel-chromium stainless series and the base superalloys.

*Produced under licensing arrangement with Shaw Processes, Ltd., London, England.

PART FOR BOTTLE capping equipment is an industrial use for process.

The Castings . . .



AIRCRAFT FUEL VALVE casting is small, intricate piece produced by this method.

TYPICAL PARTS, left to right, are: jet engine bearing housing, jet engine fuel elbow, and bottle cap guide.

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USEFUL LITERATURE
Continued from page 84

Magnesium Primer: **235**
The Stanley Chemical Co. has issued technical data on a new primer specifically designed for use on magnesium and magnesium base alloys. The new material is designed to check electrolytic decomposition where magnesium is joined to some other metal.

Cold Cleaning Metal: **236**
In a bulletin recently issued by International Chemical Co., Inc. a new cold cleaner for metals, International Compound No. 504, is described. In addition to cleaning, at room temperatures, the compound is said to have good, temporary rust preventive properties.

Improved Chromium Bath: **237**
Information is now available on a new additive for chromium plating baths that is said, by commercial platers who have used it, to materially increase the throwing power of chromium plating baths. Copies of the reports of users are available from Wagner Bros.

New Honing Compound: **238**
Technical information has been released by the International Chemical Co. on a new heavy, viscous oil compound for honing, lapping and superfinishing operations. The new compound No. 155-DS is said to be completely non-irritating to the skin.

Controlled Air Power: **239**
A new, 8 page book with colored illustrations has been prepared by The Bellows Co. This bulletin ML-3, illustrates and describes the complete line of controlled air-power devices manufactured by the company.

Cut Die-Making Cost

by reducing set-up time as much as **90%**

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permits fast, precise positioning of work-piece from ONE SET-UP. No unclamping and reclamping on your standard vertical mill equipped with ADVANCE Cross-Slide Rotary Table. Only your milling machine's table movement limits the size radius you can cut.

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MORRISON ENGINEERING COMPANY
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Refractory Material For Permanent Molds

resists attack by molten aluminum

A NEW material which has many potential applications in the field of precision molding of metals has been developed by the Refractories Division of The Carborundum Co. The list of physical properties outlined in Table 1 will suggest some of these applications.

The material, called Refrax (R), is a silicon-nitride-bonded silicon carbide which differs from conventional ceramic refractories in the nature of the bond. This material has a metal-like bond, giving this super-refractory dimensional stability during drying and firing, as well as improved properties in service.

Its resistance to surface wetting from molten aluminum alloy and its combination of thermal and physical properties, have already caused it to be introduced as a mold material for permanent mold castings, thermocouple tubes and small crucibles for non-ferrous metals. Its resistance to the action of molten aluminum has also led to its use in pumps for moving molten aluminum, and in smelting furnaces.

Improved heat shock resistance, coupled with good moduli of rupture up to temperatures of about 1000 C, and adequate tensile and compressive strength, are among the useful properties.

Some components of permanent molds have been produced in Refrax, taking advantage of its di-

Continued on next page

TABLE 1

Physical Properties of Refrax Refractories

Thermal conductivity at 1832 F (BTU/hr, sq. ft. and °F/in. of thickness)		113.5
Compressive strength at 20 C, psi		20,000
Tensile strength at 20 C, psi		3,000 to 3,500
Density, gms/cc		2.6 to 2.8
Porosity		6 to 10%
Specific heat at	0 C	0.197
	1000 C	0.297
	1400 C	0.372
Moduli of rupture, psi at	25 C	5,500
	700 C	5,500
	1000 C	7,000
	1500 C	3,000
Moduli of elasticity, psi x 10^6 at	25 C	17.0
	700 C	16.0
	1000 C	9.5
Sustained load test at 50 psi (held for 100 hr, at 1500 C) % linear change cold		+0.25
Mean coefficients of thermal expansion, °C		
	25 C— 200 C	3.26 x 10^{-6}
	25 C— 400 C	3.76 x 10^{-6}
	25 C— 600 C	4.07 x 10^{-6}
	25 C— 800 C	4.29 x 10^{-6}
	25 C—1000 C	4.47 x 10^{-6}
	25 C—1250 C	4.69 x 10^{-6}

TYPICAL SHAPES and typical physical properties are presented in the photo and tabulation above. Note the rise in modulus of rupture up to 1000 C, after which it drops off sharply.

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ALL NEW! THE FIRST COMPLETELY AUTOMATIC INDUSTRIAL INJECTOR FOR WAX OR PLASTICS

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Thermostatic controls insure correct, uniform temperatures at all times.

Large capacity tank holds up to 75 pounds of wax or plastic.

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The A·B·C is economical to operate and easy to set up. Its lightning production speeds makes single cavity molds practical and profitable.

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REFRACTORY MATERIAL FOR PERMANENT MOLDS — cont.

mensional stability and resistance to thermal shock. This material has somewhat lower thermal conductivity than other materials commonly used for permanent molds, and this fact must be considered by the mold designer.

Likewise, he should recognize that Refrax is virtually unmachinable except with diamond wheels. It is therefore necessary to form the pieces to finished shape and dimension. For this reason, the die maker furnishes an exact size model (in which all shrinkage allowances have been made) and from this model, the refractory unit is reproduced.

Normal dimensional tolerances held in this material are ±.003 per inch, while surface finish is smooth and close grained. Some recommended design limits for guidance in using this material include: imnimum wall thickness, ¼"; maximum wall thickness, 2½". Largest size produced so far is about 30" square, although this is determined only by the maximum available kiln capacity.

Protruding sections that might fracture under repeated thermal shock, are not advisable. Designers are cautioned to keep wall sections as thin as possible for optimum results.

Both internal and external threads can be formed. Standard bolts produced from this material have threads two or three times as strong as similar threads in graphite parts.

Some features of this material, in outline, are:

Chemical inertness: these refractories stand up against corrosive slags and highly reactive materials like molten synthetic mica or molten aluminum.

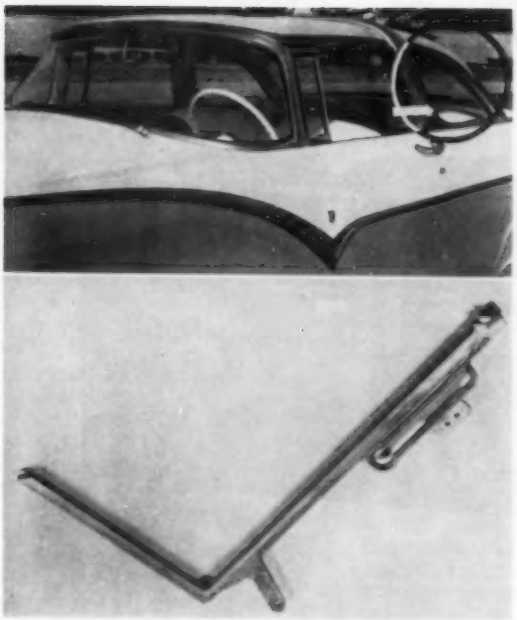
Resistance to thermal shock: resists rapid temperature changes and conditions that promote high thermal gradients better than other silicon carbide refractories.

Warpage: rigidity and stability of crystal structure at extreme temperatures eliminate troublesome warpage.

Wear resistance: more resistant to rubbing abrasion than high grade silicon carbide refractories.

Weight: material weighs about 170 lbs/cu. ft., or roughly the same as aluminum.

SIMPLIFIED SOLUTIONS FOR DESIGN PROBLEMS



DIE CASTINGS

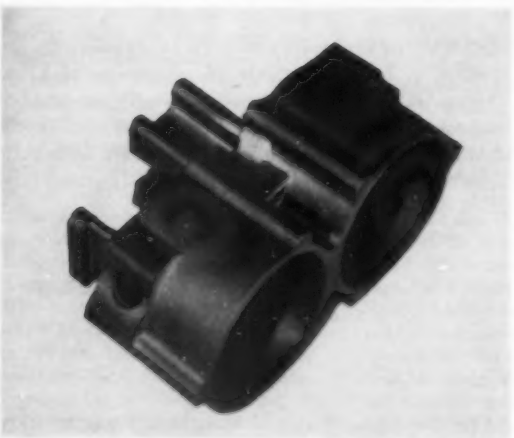
MORE AND MORE parts on today's automobiles are being converted to zinc die castings, in addition to these which have been die cast as the standard method of fabricating.

An interesting example is the channeled lower window quarter on the 1955 Ford "Hardtop" which was formerly a typical assembly of welded rolled sections and steel stampings.

It is now being die cast in zinc in a single piece measuring 24 1/2 x 13 1/4 inches. The commercial die caster who produces it, uses a single cavity die with an exceptionally long slide that cores the slot in which the glass rests.

This redesign of a cumbersome assembly into a die casting represents a reduction in cost, improved appearance and close dimensional control.

The excellent plateability of the zinc alloy, and the hardware quality of the die cast surface, combine to make die castings important parts of the styling on all 1955 and 1956 passenger cars.



INVESTMENT CASTINGS

ORIGINALLY MADE by brazing together two brass tubes, along with four other machined parts, this electronic component is now being investment cast by Jelrus Precision Casting Corp. as a single unit.

Savings of 30 percent are reported by using the single investment casting in silicon bronze alloy. A great deal of this saving comes from the reduction in expensive hand labor for assembling.

Reduction in cumulative tolerances, greater rigidity and the ability to improve design details are all results of the change from assembled fabrication to investment casting.

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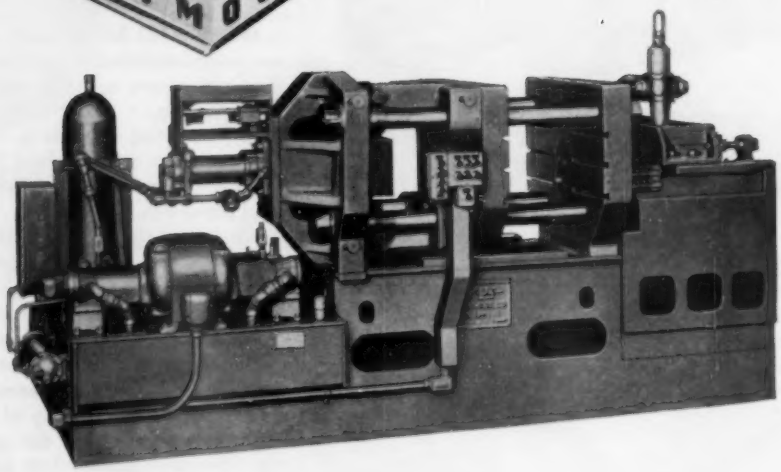

KUX DIE CASTING MACHINES

to get hardware finish quality castings

Big Chrysler Corporation contracts for die-cast trim parts are held by the Trilex Corporation of Wayne, Michigan, and Ajax Manufacturing Corporation of Detroit.

"The primary concern of the Chrysler Corporation is quality," says Mr. John Airey of Trilex. "That's why we chose KUX machines; we know they produce hardware finish quality parts."

"But Chrysler considers price as well as quality," said Mr. Milton K. Pitts of Ajax. "We choose KUX because they put us in a better position to compete on a cost-per-unit basis."

Whether your main concern is lower production costs, quality, or both, investigate the advantages of KUX machines. Quality die castings economically produced often make a tremendous difference in price and salability. KUX, first name in die casting machines, can help make that difference for you! Write for our NEW illustrated catalog.

MODEL BH-30 ILLUSTRATED

Hydraulically operated goose neck plunger type die casting machine for production of zinc, lead or tin castings.

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For more information circle No. 38 on the Reader Service Card

NEWS OF INDUSTRY AND ASSOCIATIONS

NEW JERSEY ZINC DEVELOPS TENNESSEE MINE

The New Jersey Zinc Company has started development work on its recently acquired Flat Gap property at Treadway, Tennessee, 25 miles from its Jefferson City property where a similar project has been underway for the past two years. Operations are in charge of Johnson Crawford, Tennessee superintendent for the company.

Shaft sinking operations are expected to begin this month, when installation of power facilities will have been completed. Two shafts are to be sunk—one for service and the other for ventilation.

The mining technique to be employed at Flat Gap will be "trackless". All underground ore haulage will be by Diesel trucks, thus eliminating the need for tracks, mine cars and mine locomotives. Also, trucks will be used to transport concentrates from the proposed mill, which will treat 2,000 tons of zinc ore per day, to a railroad shipping point at Morristown, Tennessee.

The orebody is a lead-free zinc sulfide ore, typical of the ore occurrences in Eastern Tennessee.

Development of the two Tennessee mines is a part of a comprehensive program to increase the Company's ore supply for the years to come. Similar mine development work is underway at its properties in Pennsylvania and Virginia. Another mine in New Mexico has resumed production and a modernization program is nearing completion at still another mine in New Jersey.

Zinc concentrates are the basic raw materials for the Company's smelters which produce zinc metals and pigments for some of the nation's major industries. Zinc metals are used principally in the die casting, brass and galvanizing industries. Zinc pigments are employed in the production of paint, rubber, ceramics and cosmetics.

AJAX JOINS EUROPEAN FIRMS IN WORK ON INDUCTION FURNACE

Ajax Engineering Corp., Trenton, N. J., has concluded an agreement with Otto Junker G.M.B.H., of Lammersdorf, Germany, and Birlec Limited, Birmingham, England, for the development and marketing of the line frequency (60 Cycles) coreless induction melting furnace.

This type of furnace, which is widely applicable to both ferrous and non-ferrous melting, has been pioneered over a number of years by Junker in Germany.

This furnace will be of particular interest to foundries melting high quality cast iron, in particular nodular cast iron, chips and turnings of ferrous or non-ferrous metals, and magnesium.

MERGER FOR CERMET PRODUCT DEVELOPMENT

Merger of The Louthan Manufacturing Company, East Liverpool, Ohio, with Ferro Powdered Metals, Inc., Salem, Ind., has been announced by R. A. Weaver, Board Chairman of Ferro Corporation, Cleveland, Ohio, parent company of both wholly-owned subsidiaries.

Strengthening of the management group, better correlation of

Continued on next page

AIRCRAFT INDUSTRY TO TELL INVESTMENT CASTERS VIEWS; ICI MEETS IN NOVEMBER IN DETROIT

The aircraft industry's views on investment cast parts and the role of such components in the planes of the future will be discussed by representatives of leading aircraft manufacturers at the Investment Casting Institute's third annual meeting in Detroit, November 1-3.

Discussions by the aircraft companies' personnel will highlight the technical sessions to be held on the second day of the convention.

Recent new casting methods such as the Glascast process, the Investment "X" and the Ellis processes will be examined and reported on by Dr. N. J. Grant, Massachusetts Institute of Technology, who is consultant for the Institute.

Additional topics to be covered during the three-day sessions will include a talk by Dr. Richard Flynn of the University of Michigan on "A Study of the Solidification Phenomena", and a discussion by Walter Sulzer of Sulzer Bros., Switzerland, on the progress of the investment casting industry in Europe. Other reports will be made on investment casting applications for gas turbines in automobiles.

The four I.C.I. Standards Committees will hold sessions during the convention. These committees include the Metal Specification Committee, R. F. Waindle chairman; Dimensional Tolerances Committee, E. G. Chapman chairman; Physical and Non-Destructive Testing Committee, B. W. Duncan chairman; and Process Materials Standards Committee, W. A. Dubovick chairman.

Study and discussion of the industry's management problems will be presented on the final day of the convention at the "members only" business session. The membership will also consider the report compiled by the certified public accounting firm of Seely and Evans, Chicago, on the investment casting industry's sales and business costs.

Members of the I. C. I. Program Planning Committee are V. S. Lazzara, Casting Engineers, Inc., chairman; Dr. N. J. Grant, M. I. T.; L. E. Brooks, Jelrus Precision Casting Company; P. F. Foley, Harcast Company; C. W. Schwartz, Misco Precision Casting Company; and P. W. Schipper, Howard Foundries, Inc.

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research and development programs and greater activity on new products were given as reasons for the merger by Mr. Weaver.

Prior to the merger, The Louthan Manufacturing Company has been a manufacturer of porcelain refractory and electrical insulations, and various products for the ceramic industry, while Ferro Powdered Metals, Inc. has been a supplier of parts to the appliance, automotive and hardware industries.

The merged company will carry on both operations under the name of The Louthan Manufacturing Company, with the Salem operation to be known as Ferro Powdered Metals Division.

It is expected that the merger will bring together research and development talent of both operations for exploratory work in the new cermet field, the name of which combines "ceramics" and "metallurgy" to achieve materials of highly specialized characteristics.

H. T. Marks, Executive-President of Ferro Corporation will be president of The Louthan Manufacturing Company; C. W. Gers-

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New improved equipment assures highest quality and production control.

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ter as executive vice-president, G. E. Weber as secretary-treasurer, and J. F. Helsel as vice-president in charge of the Ferro Powdered Metals Division are the other officers of the firm.

OFFERS DIE CASTING AND MANUFACTURING

Die castings as well as complete contract manufacturing services, are available from Harvill Corp., 6251 West Century Blvd., Los Angeles, Calif., according to an announcemeent by Robert Dreibus, vice president-sales.

Die castings of aluminum, zinc, magnesium and copper base alloys, cast to certified specifications under constant, integrated laboratory control are available in a full range of sizes and shapes.

As part of its die casting service the firm has a complete range of contract manufacturing services including engineering, tool design and tool fabrication, machining, assembly and shipping.

In addition to its 14 die casting machines rated at 600 tons or better, and 16 machines rated at 400 tons, Harvill maintains a completely-equipped production machine shop including lathes, milling machines, saws, grinders, turret lathes, drill presses, saws, punch presses, furnaces, etc.

Harvill's fully certified laboratory includes a Jarrell-Ash spectrograph, impact tester, Universal tester, X-ray, radiographic and fluoroscopic unit as well as other mechanical testing equipment.

NEWARK DIE COMPANY PUTS IN HEAVY MILLING UNITS

Heavier milling equipment for the production of larger molds and dies has been installed by the Newark Die Company, 24 Scott St., Newark, N. J., according to an announcement by Islyn Thomas, general manager of the company.

The company, which makes molds for the plastic industry as well as die casting dies, has also added a second shift to facilitate delivery of tools. Additional floor space for these operations has been made available.

KAISER INSTALLS INGOT CASTING UNIT

Ingot casting facilities costing approximately $750,000 are being installed at Kaiser Aluminum & Chemical Corporation's Mead, Washington, reduction plant, D. A.

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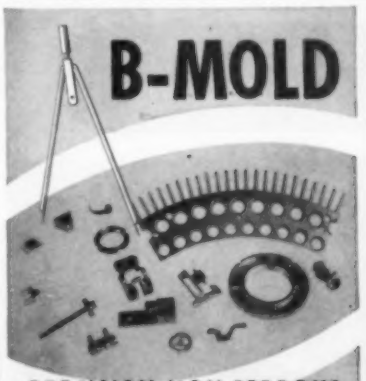

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Rhoades, the company's vice president and general manager, has announced.

The casting facilities, using the direct chill method, will supply rolling ingot for Kaiser Aluminum's nearby Trentwood sheet and plate rolling mill and other potential customers.

Although the new unit will provide an end product in a new form for Mead, it will not enlarge the total output of aluminum by the plant, which has a capacity of 350,000,000 pounds of primary aluminum a year.

GUARANTEES TITANIUM WITH LOW CARBON

Mallory-Sharon Titanium Corp. of Niles, Ohio, has announced that it is guaranteeing that its titanium and titanium alloy mill products meet a new 0.1 percent maximum carbon content requirement. Titanium meeting this specification can be machined faster, not only reducing costs, but also increasing production rates on new military aircraft.

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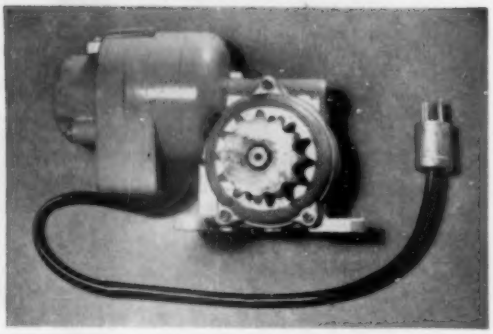
ZINC AND ALUMINUM DIE CASTING
by NELSON METAL PRODUCTS, INC.

DIE ENGINEERING
PRODUCT DESIGN
MODERN FACILITIES



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THROUGH
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ASSEMBLY COSTS
MACHINING TIME
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WESECO Impregnant P. E. #1 will increase your profits by eliminating **all porosity** in your castings. Plants in all principal cities. Send for brochure #17.

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TOP POWDER METAL TOOL ENGINEER requested by expanding large manufacturer. Splendid opportunity to progress. Salary commensurate with ability and experience. Send full particulars. Write Box No. 10555, PRECISION METAL MOLDING magazine.

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SALES ENGINEER—With experience in die casting. Must have good background in machine tools. Salary plus bonus. Write in detail to Mr. Lubalin, British Industries Corp., 80 Shore Road, Port Washington, N. Y.

MANUFACTURERS representative organizing company specializing in castings covering Penn., Md., Dela., N. J. and adjacent area. Interested in contacting quality producers of die, permanent mold, plaster, investment, shell, sand, etc. castings who need representation. Write Box 10155, PRECISION METAL MOLDING magazine.

PATENTS—Cont. from page 38

A PROCESS OF IMPREGNATING porous metal parts with a metal that is alloyable with the part. The impregnating metal is mixed with a material that is inert to both the porous part and the impregnant metal. The preform so made is placed onto porous part and heated to a temperature that will melt the impregnant. After impregnation the inert material is removed.

(Patent No. 2,715,589 — Metallic Impregnation of Porous Metal — Benjamin Smith—assigned to Ferro Powdered Metals, Inc.—issued Aug. 16, 1955).

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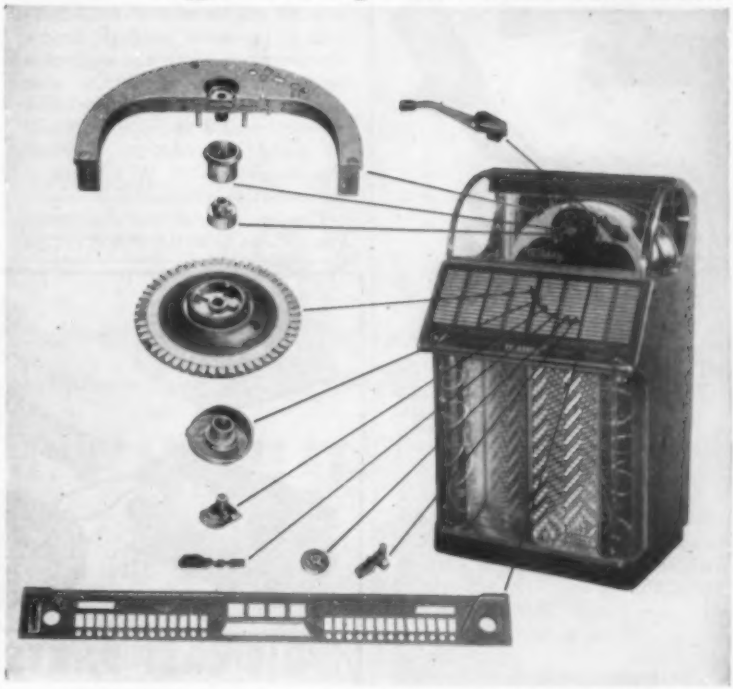

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AIRCRAFT REFUELER
continued from page 62

be possible to use the bell mouthed castings interchangeably. This shows another of the many advantages of the permanent mold casting process.

On a device of the complexity of this refueling receiver, it is not surprising that a large amount of machine work is done. Figures 1 and 2 show the rough and the machined castings with indications of the type of machining done. In this operation, permanent mold casting has shown another marked advantage. *On the finished castings with a combined weight of about 35 lbs. a saving of 4½ pounds was made over sand castings of the same general design.* Furthermore, since the engineers have become more familiar with the casting process, they feel that an additional 2 to 3 pounds could be saved by redesign. Whether this weight saving is justified is somewhat questionable.

Finally, this should be noted about these castings. One is not, in the strictest sense of the word, a permanent mold casting, but rather a semi-permanent mold casting. In other words, the major mold constituents are permanent metal molds, but where intricate cores are involved that can not be made as a portion of the metal mold or where the mold parting is such that a rigid core or insert can not be used then sand cores and inserts are applied. This use of sand cores and inserts in conjunction with permanent metal molds is another advantage of the permanent mold casting process.

Both parts are cast in Alcoa 356-T6, ASTM B108-48T SGI QQA 596 comp. 8.

NORTON BUILDS IN SOUTH

Foundations have just been completed for a new manufacturing plant owned by the Norton Company, with home offices in Worcester, Mass., according to the Daniel Construction Co. of Alabama. The new $1,285,000 plant will manufacture fused magnesia, fused zirconia, boron carbide, plus special materials for the Atomic Energy Commission. The plant will supplement the Norton Company's electric furnace facilities in Chippawa, Ontario, Canada.

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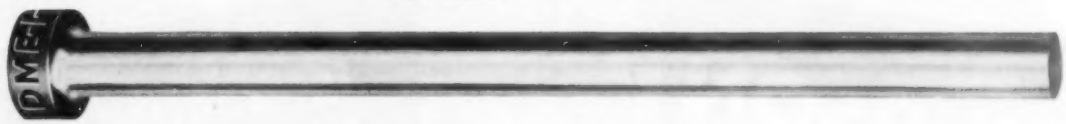

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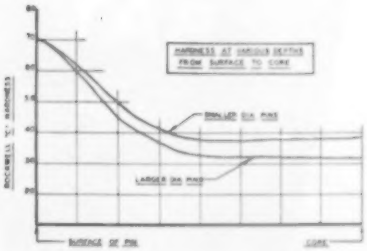

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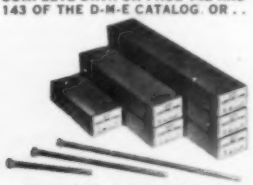

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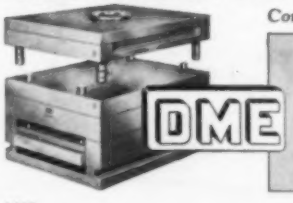

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Lock manufacturer finds key to 33⅓% cost reduction in

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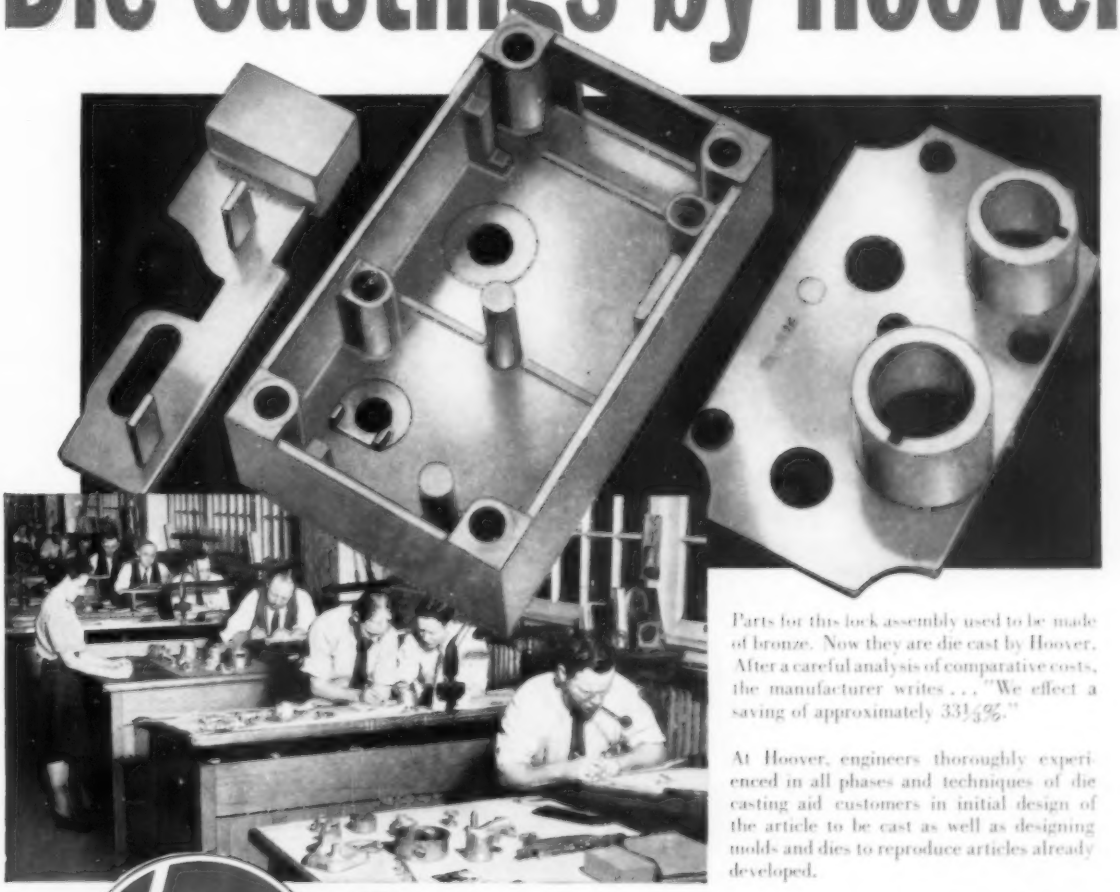

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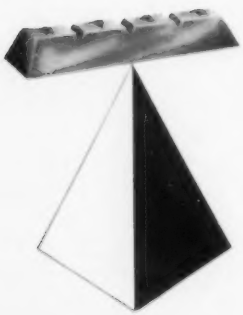

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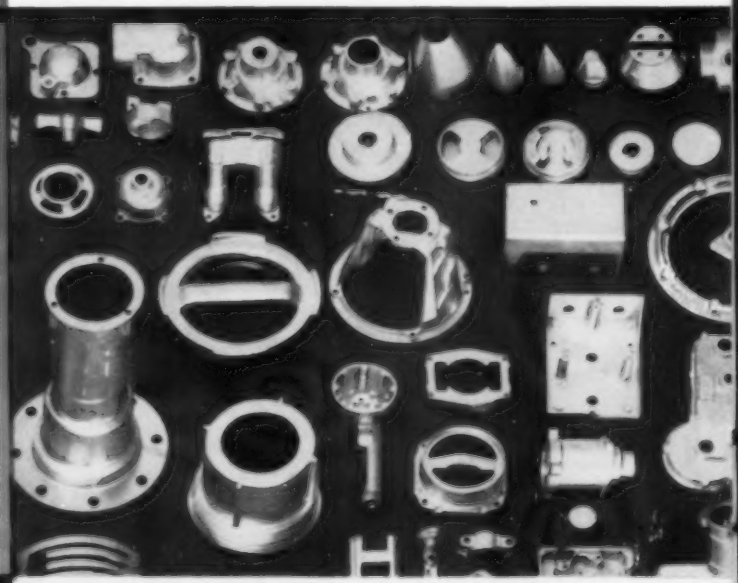

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